

Relays

**DATA
BOOK**

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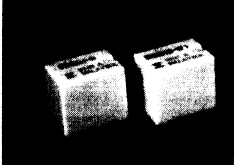
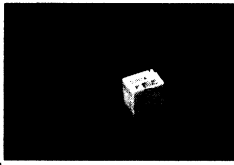

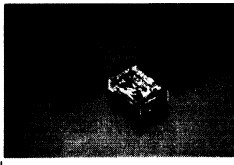
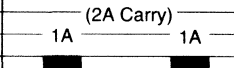
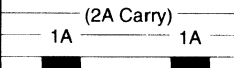
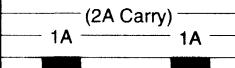
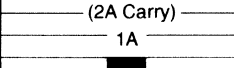
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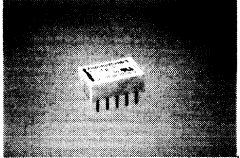
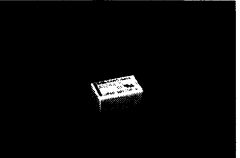
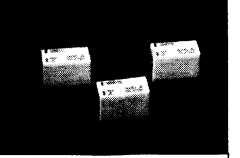
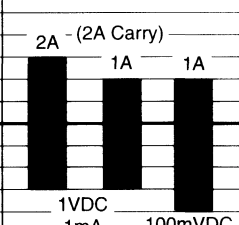
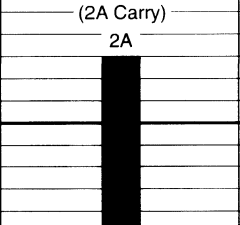
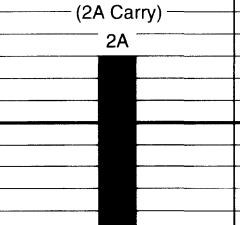
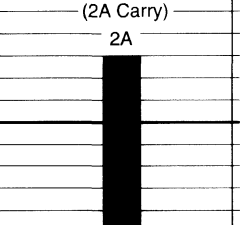
SELECTION TABLE

Signal Relays

| Series Name | FBR20 | FBR20H | SY | FBR211 |
|------------------------------------|--|--|---|--|
| Overview |  |  |  |  |
| W x L x H (mm) | *7.4 x 9.8 x 9.7 | *7.4 x 9.8 x 9.7 | 7.4 x 12.5 x 9.5 | *10.1 x 15.1 x 10.5 |
| Weight (Approximately) | 1.7 g | 1.7 g | 1.7 g | 4.0g |
| Contact Arrangement | 1c (1 Form C) | 1c (1 Form C) | 1c (1 Form C) | 1c (1 Form C) |
| Contact Rating (A) |  |  |  |  |
| Minimum Switching Load (ref.) | 1VDC 1mA 100mVDC 0.1mA | 1VDC 1mA 100mVDC 0.1mA | 1VDC 1mA 100mVDC 0.1mA | 1VDC 1mA |
| Contact Rating (Resistive Load) | 24 VDC 1 A 120 VAC 0.5 A | 24 VDC 1 A 120 VAC 0.5 A | SY 24 VDC 1 A 120 VAC 0.5 A SY-W 24 VDC 1 A 60 VAC 0.5 A | 28 VDC 1 A 120 VAC 0.5 A |
| Coil Voltage (DC) | 1.5 to 24 V | 1.5 to 24 V | 1.5 to 24 V | 1.5 to 24 V |
| Nominal Power (DC) | 0.3 W | 0.2 W to 0.25 W | 0.15 to 0.175 W | 0.2 W/0.45 W |
| Dielectric Strength | Open Contacts | 500 VAC | 500 VAC | 500 VAC |
| | Coil and Contacts | 500 VAC/1,000 VAC | 500 VAC/1,000 VAC | 500 VAC/1,000 VAC |
| Surge Strength (Coil and Contacts) | 1,500 V | 1,500 V | 1,500 V | 1,500 V |
| Expected Life | Mechanical | 5 x 10 ⁶ ops. | 5 x 10 ⁶ ops. | 5 x 10 ⁶ ops. |
| | Electrical (Rated Load) | 200 x 10 ³ ops. | 200 x 10 ³ ops. | 300 x 10 ³ ops. (DC) 100 x 10 ³ ops. (AC) |
| Safety Standards | UL, FCC68 | UL, FCC68 | UL, CSA, FCC68 | UL, CSA, FCC68 |
| Packing Style | • Tube carrier | • Tube carrier | • Tube carrier available | — |
| Remarks | • Plastic Sealed Type available (*8.2 x 10.7 x 9.7) | • Plastic Sealed Type available (*8.2 x 10.7 x 9.7) | • Plastic Sealed Type • Dial-pulse relay available | • Plastic Sealed Type available (*11.7 x 16.5 x 10.7) |
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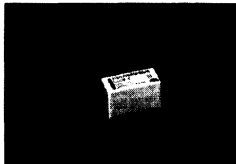
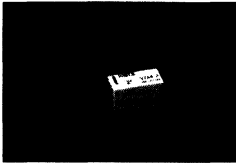
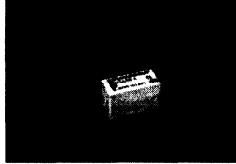
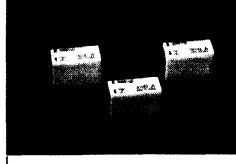
SELECTION TABLE

Signal Relays

| Series Name | MZ | A | AS (Surface Mounting Type) | FBR12 |
|------------------------------------|--|--|---|--|
| Overview |  |  |  |  |
| W x L x H (mm) | 11.4 x 15.4 x 11.0 | 9.0 x 14.0 x 5.0 | 9.0 x 14.0 x 6.5 | 7.2 x 14.6 x 9.7 |
| Weight (Approximately) | 3.5g | 1.2g | 1.5g | 1.5g |
| Contact Arrangement | 1c (1 Form C) | 2c (2 Form C) | 2c (2 Form C) | 2c (2 Form C) |
| Contact Rating (A) |  |  |  |  |
| Minimum Switching Load (ref.) | 1VDC 1mA 100mVDC 0.1mA | 10mVDC 0.01mA | 10mVDC 0.01mA | 10mVDC 0.01mA |
| Contact Rating (Resistive Load) | MZ-D 24 VDC 2 A 120 VAC 1 A MZ 24 VDC 1 A MZ-W 120 VAC 0.5 A | 30 VDC 1 A 125 VAC 0.5 A | 30 VDC 1 A 125 VAC 0.5 A | 30 VDC 1 A 125 VAC 0.5 A |
| Coil Voltage (DC) | 1.5 to 48 V | 1.5 to 24 (48*) V | 1.5 to 24 (48*) V | 1.5 to 24 V |
| Nominal Power (DC) | MZ : 0.45 to 0.50 W MZ-S: 0.19 to 0.27 W | 0.1 to 0.3 W | 0.1 to 0.3 W | 0.14 to 0.2 W |
| Dielectric Strength | Open Contacts | 500 VAC | 1,000 VAC | 750 VAC |
| | Coil and Contacts | 500 VAC/1,000 VAC (MZ-F) | 1,000 VAC | 1,000 VAC |
| Surge Strength (Coil and Contacts) | 1,500 V | 1,500 V | 1,500 V | 2,500 V |
| Expected Life | Mechanical | 20 x 10 ⁶ ops. | 100 x 10 ⁶ ops.(A) 10 x 10 ⁶ ops.(AL,AL-D) | 100 x 10 ⁶ ops.(AS) 10 x 10 ⁶ ops.(ASL,ASL-D) |
| | Electrical (Rated Load) | 500 x 10 ³ ops. (DC) 200 x 10 ³ ops. (AC) | 500 x 10 ³ ops. (DC) 200 x 10 ³ ops. (AC) | 500 x 10 ³ ops. (DC) 200 x 10 ³ ops. (AC) |
| Safety Standards | UL, CSA, FCC68 | UL, CSA, FCC68 | UL, CSA, FCC68 | UL, CSA, FCC68, Bellcore |
| Packing Style | • Tube carrier available | • Tube carrier | • Tube carrier and/or Reel Package | • Tube carrier |
| Remarks | • Plastic Sealed Type available | • Plastic Sealed Type *Only standard type • Latching Type available | • Plastic Sealed Type *Only standard type • Latching Type available | • Plastic Sealed Type |
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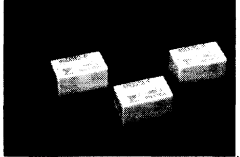


SELECTION TABLE

Signal Relays

| Series Name | NA | FBR18 (Surface Mounting Type) | NAS (Surface Mounting Type) | FBR12W | |
|------------------------------------|---|---|--|---|--|
| Overview |  |  |  |  | |
| W x L x H (mm) | 7.4 x 14.9 x 9.7 | 7.4 x 14.7 x 10.2 | 7.4 x 14.9 x 10.0 | 7.2 x 14.6 x 9.7 | |
| Weight (Approximately) | 1.6 g | 1.9 g | 1.8 g | 1.9 g | |
| Contact Arrangement | 2c (2 Form C) | 2c (2 Form C) | 2c (2 Form C) | 2c (2 Form C) | |
| Contact Rating (A) | (2A Carry) 2A | (2A Carry) 2A | (2A Carry) 2A | (2A Carry) 2A | |
| Minimum Switching Load (ref.) | 10mVDC 0.01mA | 10mVDC 0.01mA | 10mVDC 0.01mA | 10mVDC 0.01mA | |
| Contact Rating (Resistive Load) | 30 VDC 1 A 125 VAC 0.5 A | 30 VDC 1 A 125 VAC 0.5 A | 30 VDC 1 A 125 VAC 0.5 A | 30 VDC 1 A 125 VAC 0.5 A | |
| Coil Voltage (DC) | 1.5 to 24 V (48* V) | 1.5 to 24 V | 1.5 to 24 V (48* V) | 1.5 to 24 V | |
| Nominal Power (DC) | 0.1 to 0.3 W | 0.14 to 0.2 W | 0.1 to 0.3 W | 0.23 to 0.25 W | |
| Dielectric Strength | Open Contacts | 1,000 VAC | 1,000 VAC | 1,000 VAC | |
| | Coil and Contacts | 1,500 VAC (NA,NAL) 1,000 VAC (NAL-D) | 1,500 VAC | 1,500 VAC (NAS,NASL) 1,000 VAC (NASL-D) | 2,000 VAC |
| Surge Strength (Coil and Contacts) | | 2,500 V (NA,NAL) 1,500 V (NAL-D) | 2,500 V | 2,500 V (NAS,NASL) 1,500 V (NASL-D) | 5,000 V |
| Expected Life | Mechanical | 100 x 10 ⁶ ops.(NA) 10 x 10 ⁶ ops.(NAL,NAL-D) | 100 x 10 ⁶ ops. | 100 x 10 ⁶ ops.(NAS) 10 x 10 ⁶ ops.(NASL,NASL-D) | 100 x 10 ⁶ ops. |
| | Electrical (Rated Load) | 500 x 10 ³ ops. (DC) 200 x 10 ³ ops. (AC) | 500 x 10 ³ ops. (-P type DC) 200 x 10 ³ ops. (-P type AC) 200 x 10 ³ ops. (DC) 100 x 10 ³ ops. (AC) | 500 x 10 ³ ops. (DC) 200 x 10 ³ ops. (AC) | 500 x 10 ³ ops. (-P type DC) 200 x 10 ³ ops. (-P type AC) 200 x 10 ³ ops. (DC) 100 x 10 ³ ops. (AC) |
| Safety Standards | | UL, CSA, FCC68, Bellcore | UL, CSA, FCC68, Bellcore | UL, CSA, FCC68, Bellcore | UL, CSA, FCC68, IEC950 |
| Packing Style | | •Tube carrier | •Reel Package | •Tube carrier and/or Reel Package | •Tube carrier |
| Remarks | | • Plastic Sealed Type *Only standard type • Latching Type available | • Plastic Sealed Type | • Plastic Sealed Type *Only standard type • Latching Type available | • Plastic Sealed Type |
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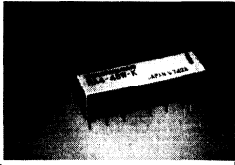

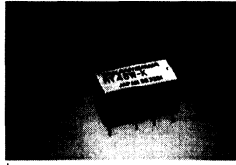

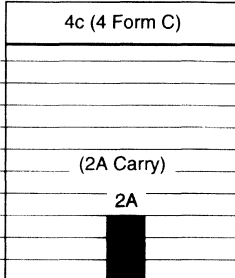
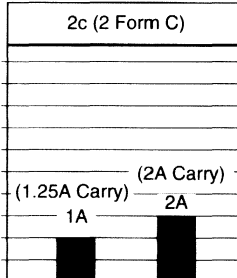
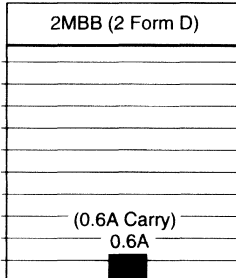
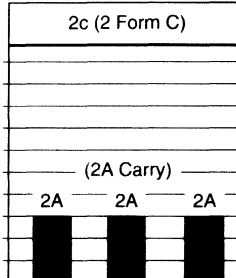
SELECTION TABLE

Signal Relays

| Series Name | BA | FBR46 | RA | FTR-B2 |
|------------------------------------|---|---|--|---|
| Overview |  |  |  |  |
| W x L x H (mm) | 7.4 x 14.9 x 9.8 | 9.8 x 15.9 x 7.9 | 10.0 x 20.05 x 9.9 | 7.62 x 17.4 x 9.4 |
| Weight (Approximately) | 1.9 g | 2.5 g | 3.7 g | 3.9 g |
| Contact Arrangement | 2c (2 Form C) | 2c (2 Form C) | 2c (2 Form C) | 2 Form C and 1 Form A (N.O.) |
| Contact Rating (A) | (2A Carry) 2A | (1.25A Carry) 1A | (2A Carry) 2A | (1.25A Carry) |
| Minimum Switching Load (ref.) | 10mVDC 0.01mA | 10mVDC 0.01mA | 10mVDC 0.01mA | 10mVDC 0.01mA |
| Contact Rating (Resistive Load) | 30 VDC 1 A 125 VAC 0.5 A | 30 VDC 1 A 125 VAC 0.5 A | 24 VDC 1 A 120 VAC 0.5 A | 30 VDC 1 A 125 VAC 0.2 A |
| Coil Voltage (DC) | 1.5 to 24 V (48* V) | 3 to 24 V | 1.5 to 48 V | 4.5, 12 V |
| Nominal Power (DC) | 0.2 to 0.36 W | 0.15 to 0.25 W | 0.075 to 0.2 W | 0.4 W |
| Dielectric Strength | Open Contacts | 750 VAC/1,000 VAC | 1,000 VAC | 750 AC |
| | Coil and Contacts | 2,000 VAC (BA,BAL) 1,000 VAC (BAL-D) | 1,000 VAC/1,500 VAC | 1,500 VAC |
| Surge Strength (Coil and Contacts) | 3,000 V (BA,BAL) 1,500 V (BAL-D) | 1,500 V/ 2,500 V | 1,500 V | 2,500 V |
| Expected Life | Mechanical | 10 x 10 ⁶ ops. | 50 x 10 ⁶ ops. | 20 x 10 ⁶ ops. |
| | Electrical (Rated Load) | 500 x 10 ³ ops. (DC) 200 x 10 ³ ops. (AC) | 200 x 10 ³ ops. (DC) 100 x 10 ³ ops. (AC) | 500 x 10 ³ ops. (DC) 200 x 10 ³ ops. (AC) |
| Safety Standards | UL, CSA, FCC68, IEC950 | UL, CSA, FCC68, Bellcore | UL, CSA, FCC68 | UL, CSA, FCC68, Bellcore |
| Packing Style | •Tube carrier | •Tube carrier | •Tube carrier available | •Tube carrier |
| Remarks | • Plastic Sealed Type *Only standard type • Latching Type available | • Plastic Sealed Type | • Dial-pulse relay available • Plastic Sealed Type • Latching Type available | • Plastic Sealed Type |
| Page | 83 | 89 | 95 | 101 |

SELECTION TABLE

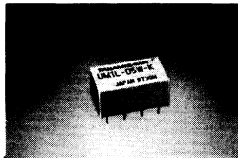
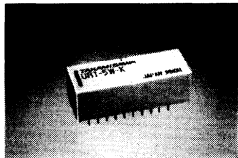
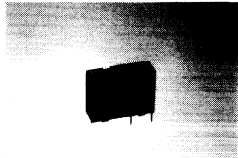
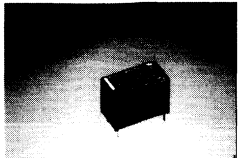
Signal Relays

| Series Name | RA4 | RY | RY-D | FBR244 |
|------------------------------------|---|--|--|---|
| Overview |  |  |  |  |
| W x L x H (mm) | 10.0 x 35.24 x 9.9 | 9.8 x 20.2 x 12.5 | 9.8 x 20.2 x 12.5 | 9.6 x 20.0 x 10.0 |
| Weight (Approximately) | 6.7 g | 5.0 g | 5.0 g | 4.5 g |
| Contact Arrangement | 4c (4 Form C) | 2c (2 Form C) | 2MBB (2 Form D) | 2c (2 Form C) |
| Contact Rating (A) |  <p>(2A Carry) 2A</p> |  <p>(2A Carry) (1.25A Carry) 1A 2A</p> |  <p>(0.6A Carry) 0.6A</p> |  <p>(2A Carry) 2A 2A 2A</p> |
| Minimum Switching Load (ref.) | 10mVDC 0.01mA | 10mVDC 0.01mA | 100mVDC 0.1mA | 5VDC 5mA 1VDC 1mA 100mVDC 0.1mA |
| Contact Rating (Resistive Load) | 24 VDC 1 A 120 VAC 0.5 A | RY-W,WZ 24 VDC 1 A 120 VAC 0.5 A RY-WF 24 VDC 1 A 120 VAC 0.25 A RY-WFZ 30 VDC 2 A 125 VAC 0.5 A | 48 VDC 0.15 A 120 VAC 0.3 A | 30 VDC 1 A 120 VAC 0.5 A |
| Coil Voltage (DC) | 1.5 to 48 V | 4.5 to 48 V | 4.5 to 48 V | 3 to 48 V |
| Nominal Power (DC) | 0.09 to 0.2 W | 0.15 to 0.58 W | 0.45 to 0.48 W | 0.5 to 0.58 W |
| Dielectric Strength | Open Contacts | 500 VAC (W,WZ,WFZ) 1,000 VAC (WF) | 500 VAC | 500 VAC |
| | Coil and Contacts | 1,500 VAC | 1,000 VAC | 500 VAC/1,000 VAC |
| Surge Strength (Coil and Contacts) | 1,500 V | 1,500 V | 1,500 V | 1,500 V |
| Expected Life | Mechanical | 20 x 10 ⁶ ops. | 20 x 10 ⁶ ops. (W) 10 x 10 ⁶ ops. (WF, WZ, WFZ) | 20 x 10 ⁶ ops. |
| | Electrical (Rated Load) | 500 x 10 ³ ops. (DC) 200 x 10 ³ ops. (AC) | 100 x 10 ³ ops. (DC 30V 2 A)*1 200 x 10 ³ ops. (AC120A 0.5 A)*2 500 x 10 ³ ops. (DC 24V 1 A, AC 120V 0.25 A) | 500 x 10 ³ ops. (DC) 100 x 10 ³ ops. (AC) |
| Safety Standards | UL, CSA, FCC68 | UL, CSA, FCC68 | UL, CSA, FCC68 | UL, CSA, FCC68 |
| Packing Style | • Tube carrier available | • Tube carrier available | • Tube carrier available | • Tube carrier |
| Remarks | • Plastic Sealed Type • Latching Type available | • Plastic Sealed Type *1 RY-WFZ *2 RY-W,WZ | • Plastic Sealed Type | • Plastic Sealed Type available |
| Page | 105 | 111 | 111 | 119 |

SELECTION TABLE

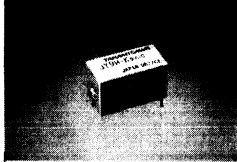

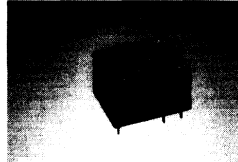
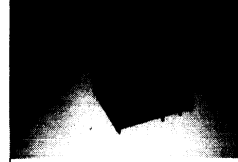
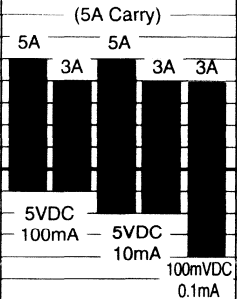
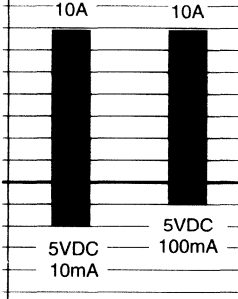
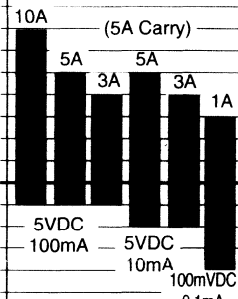
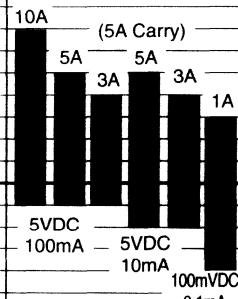
High Frequency Relays

Power Relays

| Series Name | UM1 | UR1 | FTR-F3 | JV |
|------------------------------------|---|---|--|---|
| Overview |  |  |  |  |
| W x L x H (mm) | 11.5 x 20.1 x 10.0 | 12.7 x 32.7 x 10.8 | 7.0 x 20.3 x 15.0 | 10.0 x 17.5 x 12.5 |
| Weight (Approximately) | 4.0 g | 7.0 g | 4.0 g | 4.7 g |
| Contact Arrangement | 1c (1 Form C) | 2c (2 Form C) | 1 Form A | 1a (1 Form A) |
| Contact Rating (A) | (0.5A Carry) 0.1A | (0.5A Carry) 0.1A | (5A Carry) 3A | (5A Carry) 5A |
| Minimum Switching Load (ref.) | 10mVDC 0.01mA | 10mVDC 0.01mA | 5VDC 10mA | 5VDC 100mA |
| Contact Rating (Resistive Load) | 24 VDC 10 mA 1 W (900 MHz) | 24 VDC 10 mA 1 W (900 MHz) | 30 VDC/250 VAC 3 A | 30 VDC/250 VAC 5 A |
| Coil Voltage (DC) | 1.5 to 48 V | 1.5 to 48 V | 5 to 24 V | 3 to 24 V |
| Nominal Power (DC) | 0.2 to 0.4 W | 0.25 to 0.55 W | 0.2 W | 0.2 W/0.3 W |
| Dielectric Strength | Open Contacts | 500 VAC | 500 VAC | 500 VAC |
| | Coil and Contacts | 1,000 VAC | 1,000 VAC | 1,000 VAC |
| Surge Strength (Coil and Contacts) | — | — | 10,000 V | 10,000 V |
| Expected Life | Mechanical | 1 x 10 ⁶ ops. | 5 x 10 ⁶ ops. | 5 x 10 ⁶ ops. |
| | Electrical (Rated Load) | 300 x 10 ³ ops. | 300 x 10 ³ ops. | 100 x 10 ³ ops. |
| Safety Standards | — | — | Conforms to UL, CSA, VDE, approved | UL, CSA (NRTL/C), VDE |
| Packing Style | — | — | •Tube carrier | •Tube carrier |
| Remarks | <ul style="list-style-type: none"> • Plastic Sealed Type • Isolation 60dB min • Insertion Loss 1dB max. • V.S.W.R. 1.2 max. (at 900 MHz) • Latching Type available | <ul style="list-style-type: none"> • Plastic Sealed Type • Isolation 60dB min • Insertion Loss 1dB max. • V.S.W.R. 1.2 max. (at 900 MHz) • Latching Type available | <ul style="list-style-type: none"> • Plastic Sealed Type | <ul style="list-style-type: none"> • Plastic Sealed Type |
| Page | 123 | 129 | 135 | 139 |


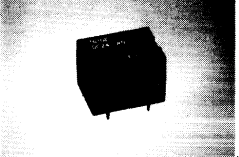
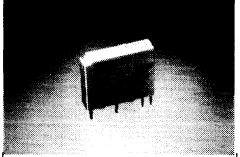

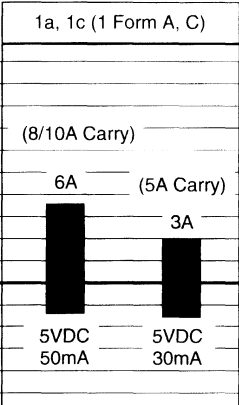
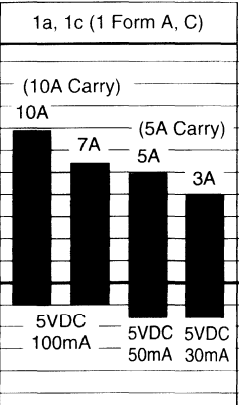
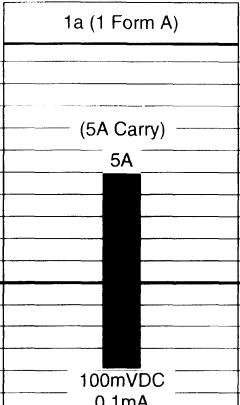
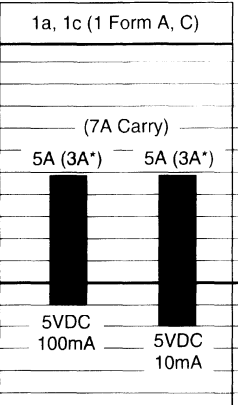
SELECTION TABLE

Power Relays

| Series Name | JY | JS | LZ | LZG |
|------------------------------------|--|--|--|--|
| Outview |  |  |  |  |
| W x L x H (mm) | 10.0 x 20.0 x 12.8 | 10.0 x 29.0 x 12.5 | 16.4 x 21.4 x 14.8 | 17.4 x 21.9 x 16.1 |
| Weight (Approximately) | 5.0 g | 8.0 g | 7.7 g | 9.2 g |
| Contact Arrangement | 1a (1 Form A) | 1a, 1c (1 Form A, C) | 1a, 1c (1 Form A, C) | 1a, 1c (1 Form A, C) |
| Contact Rating (A) |  |  |  |  |
| Minimum Switching Load (ref.) | 5VDC 100mA, 5VDC 10mA, 100mVDC 0.1mA | 5VDC 10mA, 5VDC 100mA | 5VDC 100mA, 5VDC 10mA, 100mVDC 0.1mA | 5VDC 100mA, 5VDC 10mA, 100mVDC 0.1mA |
| Contact Rating (Resistive Load) | (5 A Type) 30 VDC/250 VAC 5 A (3 A Type) 30 VDC/250 VAC 3 A | 24 VDC/250 VAC 8 A | (5 to 10 A Type) 24 VDC/120 VAC 10 A 24 VDC/120 VAC 5 A (1 to 3 A Type) 30 VDC/120 VAC 3 A 30 VDC/120 VAC 1 A | (5 to 10 A Type) 24 VDC/120 VAC 10 A 24 VDC/120 VAC 5 A (1 to 3 A Type) 30 VDC/120 VAC 3 A 30 VDC/120 VAC 1 A |
| Coil Voltage (DC) | 4.5 to 48 V | 5 to 60 V | 1.5 to 24 (100*) V | 1.5 to 24 (48*) V |
| Nominal Power (DC) | 0.2 to 0.36 W | 5 to 60 V | 0.33 W/0.45 to 0.6 W | 0.33 W/0.45 to 0.6 W |
| Dielectric Strength | Open Contacts | 1,000 VAC | 750 VAC | 750 VAC |
| | Coil and Contacts | 2,000 VAC | 2,000 VAC | 2,500 VAC |
| Surge Strength (Coil and Contacts) | 4,000 V/5,000 V | 5,000 VAC | 2,000 VAC | 2,500 VAC |
| Expected Life | Mechanical | 10,000 V | 4,000 V/6,000 V | 7,000 V |
| | Electrical (Rated Load) | 20 x 10 ⁶ ops. | 10,000 V | 4,000 V/6,000 V |
| Safety Standards | 20 x 10 ⁶ ops. | 20 x 10 ⁶ ops. | 20 x 10 ⁶ ops. | 20 x 10 ⁶ ops. |
| Packing Style | 100 x 10 ³ ops. | 20 x 10 ⁶ ops. | 20 x 10 ⁶ ops. | 20 x 10 ⁶ ops. |
| Remarks | UL, CSA, VDE, SEV | 100 x 10 ³ ops. | 100 x 10 ³ ops. | 100 x 10 ³ ops. |
| Page | UL, CSA, VDE, SEV • Tube carrier available | UL, CSA, VDE, SEV, SEMKO, OVE, FIMKO, BSI • Tube carrier • Plastic Sealed Type | UL, CSA • Tube carrier available • Plastic Sealed Type available *Only standard type | UL, CSA, VDE • Tube carrier available • Plastic Sealed Type available *Only standard type |
| | 143 | 149 | 155 | 163 |

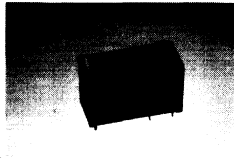
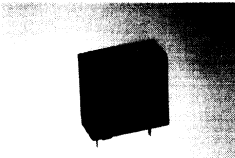
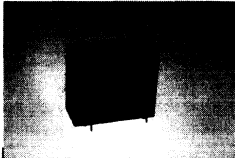
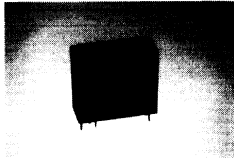
SELECTION TABLE

Power Relays

| Series Name | FBR100 | FBR160 | NY | VE |
|------------------------------------|--|---|---|---|
| Outview |  |  |  |  |
| W x L x H (mm) | *16.0 x 20.7 x 23 | 16.2 x 21.7 x 16.2 | 5.0 x 20.0 x 17.0 | 10.5 x 20.5 x 20.5 |
| Weight (Approximately) | 8.0 g | 11.0 g | 3.5 g | 8.0 g |
| Contact Arrangement | 1a, 1c (1 Form A, C) | 1a, 1c (1 Form A, C) | 1a (1 Form A) | 1a, 1c (1 Form A, C) |
| Contact Rating (A) |  |  |  |  |
| Minimum Switching Load (ref.) | 5VDC 50mA, 5VDC 30mA | 5VDC 100mA, 5VDC 50mA, 5VDC 30mA | 100mVDC 0.1mA | 5VDC 100mA, 5VDC 10mA |
| Contact Rating (Resistive Load) | (6 A Type) 28 VDC 6 A 120 VAC 6 A (3 A Type) 28 VDC 3 A 120 VAC 3 A | (10 A type) 28 VDC 10 A (-WB type) 120 VAC 7 to 10 A (-HB type) (3 to 5 A type) 28 VDC 5 A (-W type) 28 VDC/120 VAC 3 to 5 A | 30 VDC/250 VAC 5 A | VE-() H5 250 VAC 5 A VE-() H 250 VAC 5 A/3 A* |
| Coil Voltage (DC) | 5 to 48 V | 5 to 24 V | 4.5 to 24 V | 5 to 48 V |
| Nominal Power (DC) | 0.36 to 0.5 W | 0.36 W/ 0.5 W | 0.12 W | 0.25 W/ 0.36 W |
| Dielectric Strength | Open Contacts | 500 VAC | 500 VAC | 750 VAC |
| | Coil and Contacts | 500 VAC 1,500 VAC (High dielectric strength type) | 1,500 VAC | 3,000 VAC |
| Surge Strength (Coil and Contacts) | 3,500 V | 4,000 V | 5,080 V | 4,000 V/6,000 V |
| Expected Life | Mechanical | 10 x 10 ⁶ ops. | 10 x 10 ⁶ ops. | 20 x 10 ⁶ ops. |
| | Electrical (Rated Load) | 100 x 10 ³ ops. | 100 x 10 ³ ops. | 30 x 10 ³ ops. (AC250V 5A) 100 x 10 ³ ops. (DC 30V 5A) 150 x 10 ³ ops. (AC250V 3A) |
| Safety Standards | UL, CSA | UL, CSA | UL, CSA | UL, CSA, VDE |
| Packing Style | • Tube carrier available | • Tube carrier available | • Tube carrier | • Tube carrier |
| Remarks | • Plastic Sealed Type available (*16.0 x 20.7 x 23.5) | • Plastic Sealed Type available | • Plastic Sealed Type • Socket available • IEC-1010 type available | • Plastic Sealed Type • VE-() H NC contact |
| Page | 169 | 175 | 181 | 187 |


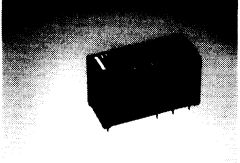
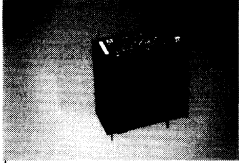

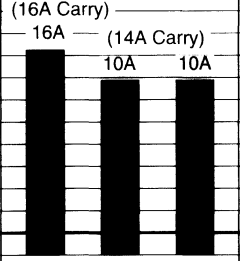
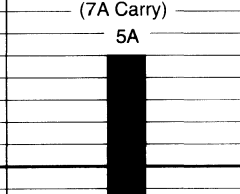
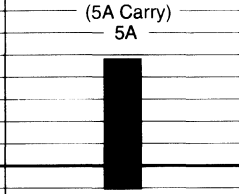
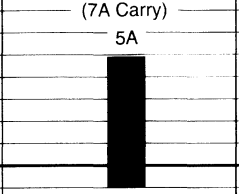
SELECTION TABLE

Power Relays

| Series Name | FTR-H1 | FTR-H2 | VS | VSB |
|------------------------------------|--|---|--|---|
| Overview |  |  |  |  |
| W x L x H (mm) | 12.8 x 28.0 x 16.5 | 12.8 x 28.0 x 16.5 | 12.9 x 29.2 x 25.3 | 12.9 x 29.2 x 25.3 |
| Unit Mass (Approx.) | 12.0 g | 12.0 g | 17.0 g | 18.0 g |
| Weight (Approximately) | 1a, 1c (1 Form A, C) | 1a, 1c (1 Form A, C) | 1a, 1c (1 Form A, C) | 1a, 1c (1 Form A, C) |
| Contact Rating (A) | (12A Carry) 10A | (10A Carry) 10A | (15A Carry) 15A (14A Carry) 10A 10A | (16A Carry) 16A |
| Minimum Switching Load (ref.) | 5VDC 10mA | 5VDC 10mA | 5VDC 100mA 5VDC 10mA | 5VDC 100mA |
| Contact Rating (Resistive Load) | 30 VDC/250 VAC 10 A | 30 VDC/250 VAC 10 A | VS-NR 24 VDC/120 VAC 15 A VS 24 VDC/240 VAC 10 A | 30 VDC/250 VAC 16 A |
| Coil Voltage (DC) | 5 to 48 V | 5 to 48 V | 3 to 100 V | 3 to 100 V |
| Nominal Power (DC) | 0.4 to 0.53 W | 0.25 to 0.53 W | 0.53 W/ 0.75 W | 0.53 W/ 0.75 W |
| Dielectric Strength | Open Contacts | 1,000 VAC | 1,000 VAC | 1,000 VAC |
| | Coil and Contacts | 5,000 VAC | 4,000 VAC | 5,000 VAC |
| Surge Strength (Coil and Contacts) | 10,000 V | 10,000 V | 10,000 V | 10,000 V |
| Expected Life | Mechanical | 20 x 10 ⁶ ops. | 20 x 10 ⁶ ops. | 20 x 10 ⁶ ops. |
| | Electrical (Rated Load) | 100 x 10 ³ ops. | 100 x 10 ³ ops. | 100 x 10 ³ ops. |
| Safety Standards | CSA, IMQ, BSI (Conforms to UL, VDE, SEMKO, FIMKO, DEMKO) | IMQ, BSI (Conforms to UL, CSA, VDE, SEMKO) | UL, CSA, VDE, SEV, SEMKO, FIMKO, IMQ | UL, CSA, VDE, SEV, SEMKO, IMQ, OVE, BSI |
| Packing Style | • Tube carrier | • Tube carrier | • Tube carrier available | • Tube carrier available |
| Remarks | • Plastic Sealed Type • Compatible with VS & FBR610 Type Relay Terminals • TV-5 type available | • Flux Free Type • TV-5 type | • Plastic Sealed Type available • TV-5/8 type available | • Plastic Sealed Type available • Tube carrier available |
| Page | 193 | 199 | 205 | 213 |

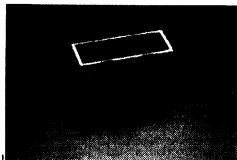
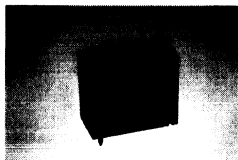


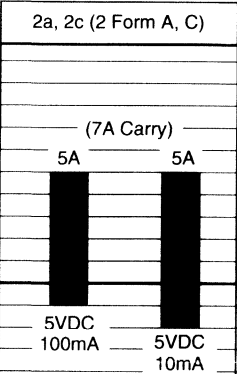
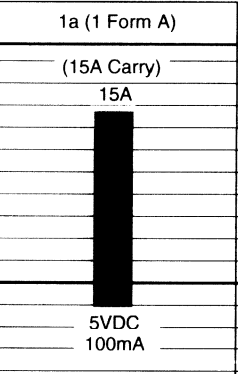
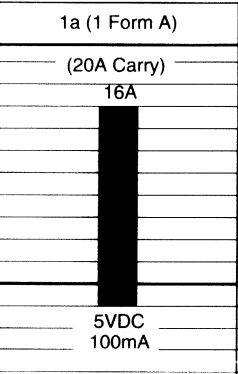
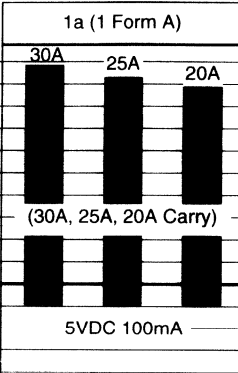
SELECTION TABLE

Power Relays

| Series Name | FBR610 | FTR-F1 | FTR-F2 | FBR620 |
|------------------------------------|---|--|--|---|
| Overview |  |  |  |  |
| W x L x H (mm) | 12.6 x 28.7 x 24.7 | 12.8 x 29.0 x 16.5 | 12.8 x 29.0 x 16.5 | 12.6 x 28.7 x 24.7 |
| Weight (Approximately) | 16.0 g | 10.0 g | 12.0 g | 16.0 g |
| Contact Arrangement | 1a, 1b, 1c (1 Form A, B, C) | 2a, 2c (2 Form A, C) | 1 Form A | 2a, 2b, 2c (2 Form A, B, C) |
| Contact Rating (A) |  <p>(16A Carry) 16A (14A Carry) 10A 10A</p> |  <p>(7A Carry) 5A</p> |  <p>(5A Carry) 5A</p> |  <p>(7A Carry) 5A</p> |
| Minimum Switching Load (ref.) | 5VDC 100mA | 5VDC 10mA | DC5V 100mA | 5VDC 100mA |
| Contact Rating (Resistive Load) | (K type 1a, 1b) 30 VDC 16 A 240 VAC 16 A (Standard, K type 1c) 30 VDC/240 VAC 10 A | 24 VDC/250 VAC 5 A | 30 VDC/250 VAC 5 A | 30 VDC/240 VAC 5 A |
| Coil Voltage (DC) | 5 to 60 V | 5 to 48 V | 5 to 48 V | 5 to 60 V |
| Nominal Power (DC) | 0.5 W | 0.4 to 0.53 W | 0.25 to 0.53 W | 0.5 W |
| Dielectric Strength | Open Contacts | 1,000 VAC | 1,000 VAC | 1,000 VAC |
| | Coil and Contacts | 5,000 VAC | 5,000 VAC | 5,000 VAC |
| Surge Strength (Coil and Contacts) | 10,000 V | 10,000 V | 10,000 V | 10,000 V |
| Expected Life | Mechanical | 20 x 10 ⁶ ops. | 20 x 10 ⁶ ops. | 20 x 10 ⁶ ops. |
| | Electrical (Rated Load) | 100 x 10 ³ ops. (DC, K type AC) 200 x 10 ³ ops. (AC) | 100 x 10 ³ ops. | 1 x 10 ⁵ ops. |
| Safety Standards | UL, CSA, VDE | Conforms to UL, CSA, VDE, FIMKO SEMKO, IMQ | Conforms to UL, CSA, VDE, (SEMKO pending) | UL, CSA |
| Packing Style | — | •Tube carrier | •Tube carrier | — |
| Remarks | • Plastic Sealed Type available | • Plastic Sealed Type available • Compatible with VB & FBR620 Type Relay Terminals • TV-3 type available | • Flux Free Type • TV-5 type | • Plastic Sealed Type available |
| Page | 219 | 225 | 231 | 219 |

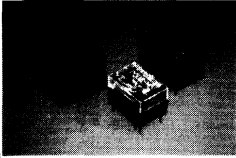
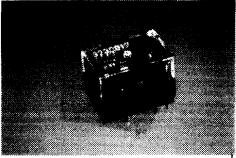
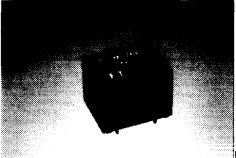
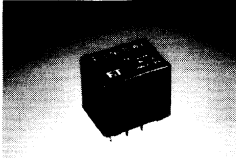
SELECTION TABLE

Power Relays

| Series Name | VB | VR | VH | VF |
|------------------------------------|--|---|--|---|
| Overview |  |  |  |  |
| W x L x H (mm) | 12.9 x 29.2 x 25.3 | 15.0 x 30.0 x 26.2 | 18.0 x 30.1 x 30.0 | 32.2 x 50.0 x 24.1 |
| Weight (Approximately) | 17.0 g | 24.0 g | 35.0 g | 55.0 g |
| Contact Arrangement | 2a, 2c (2 Form A, C) | 1a (1 Form A) | 1a (1 Form A) | 1a (1 Form A) |
| Contact Rating (A) |  <p>5A 5A (7A Carry)</p> |  <p>15A (15A Carry)</p> |  <p>16A (20A Carry)</p> |  <p>30A 25A 20A (30A, 25A, 20A Carry)</p> |
| Minimum Switching Load (ref.) | 5VDC 100mA 5VDC 10mA | 5VDC 100mA | 5VDC 100mA | 5VDC 100mA |
| Contact Rating (Resistive Load) | 24 VDC/250 VAC 5 A | 30 VDC/277 VAC 15 A | 250 VAC 16 A | 250 VAC 20 to 30 A |
| Coil Voltage (DC) | 3 to 100 V | 3 to 60 V | 5 to 60 V | 3 to 60 V |
| Nominal Power (DC) | 0.53 W/ 0.75 W | 0.8 W | 0.9 to 1.0 W | 1.2 W |
| Dielectric Strength | Open Contacts | 5,000 VAC | 5,000 VAC | 1,000 VAC |
| | Coil and Contacts | 10,000 V | 10,000 V | 4,000 VAC |
| Surge Strength (Coil and Contacts) | 20 x 10 ⁶ ops. | 5 x 10 ⁶ ops. | 7,000 V | 10,000 V |
| Expected Life | Mechanical | 100 x 10 ³ ops. | 100 x 10 ³ ops. | 5 x 10 ⁶ ops. |
| | Electrical (Rated Load) | UL, CSA, VDE, SEV, SEMKO, FIMKO, IMQ | UL, CSA, VDE | 100 x 10 ³ ops. |
| Safety Standards | • Tube carrier available | — | UL, CSA | UL, CSA, VDE |
| Packing Style | • Plastic Sealed Type available • TV-3 type available • Tube carrier available | • Flux Free Type • Tab-terminal (#187)/PCB terminals • TV-5 type | — | — |
| Remarks | | | • Flux Free Type • Tab-terminal (#250) • TV-10 type | • Flux Free Type • Tab-terminal • TV-15 type |
| Page | 237 | 245 | 251 | 255 |

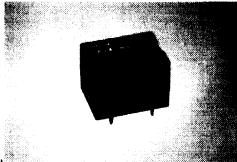
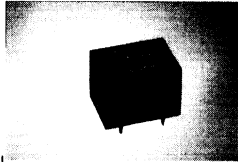
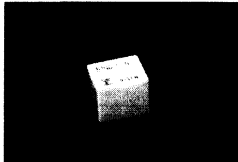
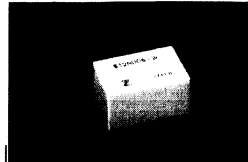
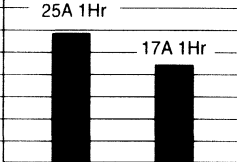
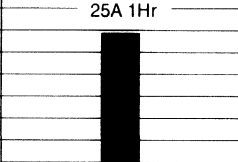
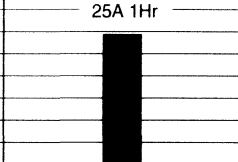
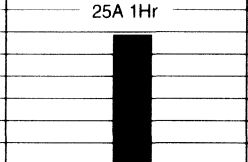
SELECTION TABLE

Automotive Relays

| Series Name | FBR211 | FBR321 | FTR-P1 (Quiet Type) | FTR-P2 (Quiet Type) |
|-------------------------------|---|---|---|---|
| Overview |  |  |  |  |
| W x L x H (mm) | *10.1 x 15.1 x 10.5 | *14.4 x 23.0 x 17.5 | 16.9 x 21.8 x 16.3 | 16.5 x 21.0 x 18.0 |
| Weight (Approximately) | 4.0 g | 12.0 g | 10.0 g | 13.0 g |
| Contact Arrangement | 1c (1 Form C) | 2c (2 Form C) | 1c (1 Form C) | 1c (1 Form C)x 2 |
| Contact Rating (A) | 3A 1Hr | 6A 1Hr | 20A 1Hr | 25A 1Hr |
| Expected Life of Load Example | 14 VDC Inrush 8 A Condenser Load Lamp Load 100 x 10 ³ ops. 14 VDC 2 A Motor Lock 200 x 10 ³ ops. | 14 VDC Inrush 12 A Break 1 A Motor Free 100 x 10 ³ ops. | 14 VDC Inrush 20 A Break 4 A Motor Free 1 x 10 ⁶ ops. 14 VDC 20 A Motor Lock 200 x 10 ³ ops. | 14 VDC Inrush 17 A Break 1.5 A Motor Free 500 x 10 ³ ops. 14 VDC 25 A Motor Lock 300 x 10 ³ ops. |
| Coil Voltage (DC) | 9 to 12 V | 9 to 12 V | 9 to 12 V | 9 to 12 V |
| Nominal Power (DC) | 0.2 W/0.45 W | 0.6 W | 0.6 W/0.8 W | 0.45 W |
| Dielectric Strength | Open Contacts | 500 VAC | 500 VAC | 500 VAC |
| | Coil and Contacts | 500 VAC | 500 VAC | 500 VAC |
| Packing Style | — | — | • Tube Carrier | • Tube Carrier available |
| Remarks | • Plastic Sealed Type available (*11.7 x 16.5 x 10.7) | • Plastic Sealed Type available (*15.8 x 24.4 x 17.5) | • Plastic Sealed Type | • Plastic Sealed Type • Low-acoustic noise type (50 dB) |
| Page | 261 | 265 | 269 | 275 |

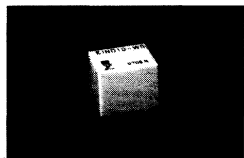
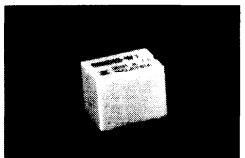
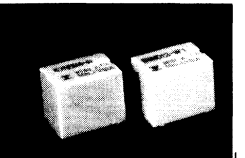
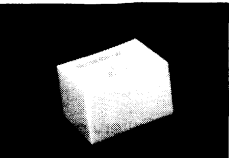
SELECTION TABLE

Automotive Relays

| Series Name | FBR161 | FBR166 | FBR51/52 | FBR512/522 (Mini Twin) |
|-------------------------------|---|---|--|--|
| Outview |  |  |  |  |
| W x L x H (mm) | 16.2 x 21.7 x 16.2 | 16.2 x 21.7 x 16.2 | 12.1 x 15.5 x 13.7 | 16.2 x 24.0 x 14.1 |
| Weight (Approximately) | 11.0 g | 11.0 g | 6.0 g | 12.0 g |
| Contact Arrangement | 1c (1 Form C) | 1c (1 Form C) | 1c (1 Form C) | 1c (1 Form C) x 2 |
| Contact Rating (A) |  |  |  |  |
| Expected Life of Load Example | 14 VDC Inrush 25 A Break 5 A Motor Free 500 x 10 ³ ops. 14 VDC 25 A Motor Lock 100 x 10 ³ ops. | 14 VDC Inrush 25 A Break 5 A Motor Free 500 x 10 ³ ops. 14 VDC 25 A Motor Lock 200 x 10 ³ ops. | 14 VDC Inrush 20 A Break 5 A Motor Free 400 x 10 ³ ops. 14 VDC 20 A Motor Lock 200 x 10 ³ ops. <High Power type> 14 VDC 25 A Motor Lock 200 x 10 ³ ops. 14 VDC 30 A Motor Lock 100 x 10 ³ ops. | 14 VDC Inrush 20 A Break 5 A Motor Free 400 x 10 ³ ops. 14 VDC 20 A Motor Lock 200 x 10 ³ ops. <High Power type> 14 VDC 25 A Motor Lock 200 x 10 ³ ops. 14 VDC 30 A Motor Lock 100 x 10 ³ ops. |
| Coil Voltage (DC) | 9 to 12 V | 6 to 12 V | 6 to 12 V | 6 to 12 V |
| Nominal Power (DC) | 0.5 W | 0.68 W | 0.6 W/0.8 W | 0.6 W/0.8 W |
| Dielectric Strength | Open Contacts | 500 VAC | 500 VAC | 500 VAC |
| | Coil and Contacts | 1,500 VAC | 1,500 VAC | 500 VAC |
| Packing Style | • Tube Carrier available | • Tube Carrier available | • Tube Carrier | • Tube Carrier |
| Remarks | • Plastic Sealed Type available | • Plastic Sealed Type available | • Plastic Sealed Type | • Plastic Sealed Type |
| Page | 281 | 281 | 285 | 293 |

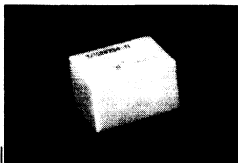

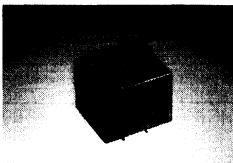
SELECTION TABLE

Automotive Relays

| Series Name | FBR51/512(-WR) (For Flasher Lamp Load) | FBR56 | FBR57 (For 24V battery) | FBR562 (High power twin) |
|-------------------------------|--|--|--|---|
| Overview |  |  |  |  |
| W x L x H (mm) | 12.1 x 15.5 x 13.7 | 14.4 x 20.0 x 16.2 | 14.4 x 20.0 x 16.2 | 20.0 x 26.0 x 16.2 |
| Weight (Approximately) | 6.0 g | 9.4 g | 9.4 g | 18.0 g |
| Contact Arrangement | 1c (1 Form C)/1c (1FormC)x2 | 1c (1 Form C) | 1c (1 Form C) | 1c (1 Form C) x 2 |
| Contact Rating (A) | 25A 1Hr | 30A 1Hr | 30A 1Hr | 30A 1Hr |
| Expected Life of Load Example | Tungsten Lamp Load (12 V 23 W x 5 pcs.+ 12 V 10 W x 2 pcs.) Inrush 28 A Break 12 A (0.5 s ON,0.5 s OFF) 10 x 10 ⁶ ops. Inrush 90 A Break 18 A (0.25 s ON,4.75 s OFF) 1 x 10 ⁶ ops. | 14 VDC Inrush 27 A Break 4 A Motor Free 1 x 10 ⁶ ops. 14 VDC 30 A (20A) Motor Lock 100 x 10 ³ (200 x 10 ³) ops. | 28 VDC 12 A Motor Lock 100 x 10 ³ ops. | 14 VDC Inrush 27 A Break 4 A Motor Free 1 x 10 ⁶ ops. 14 VDC 30 A (20 A) Motor Lock 100 x 10 ³ (200 x 10 ³) ops. |
| Coil Voltage (DC) | 9 to 12 V | 6 to 12 V | 24 V | 6 to 24 V |
| Nominal Power (DC) | 0.6 W | 0.85 W | 1.5 W | 0.85 W/1.5 W |
| Dielectric Strength | Open Contacts | 500 VAC | 500 VAC | 500 VAC |
| | Coil and Contacts | 500 VAC | 500 VAC | 500 VAC |
| Packing Style | • Tube Carrier | • Tube Carrier | • Tube Carrier | • Tube Carrier |
| Remarks | • Plastic Sealed Type | • Plastic Sealed Type | • Plastic Sealed Type | • Plastic Sealed Type |
| Page | 301 | 307 | 315 | 321 |

SELECTION TABLE


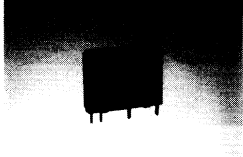
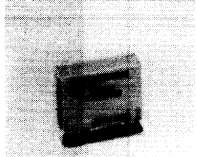
Automotive Relays

| Series Name | FBR572/582 (For 24V battery Twin) | FRL-274 | FRL-274 (40A Type) |
|-------------------------------|--|---|--|
| Overview |  |  |  |
| W x L x H (mm) | 20.0 x 26.0 x 16.2/ 20.0 x 26.0 x 17.0 | 21.3 x 23.7 x 19.2 | 21.3 x 23.7 x 19.7 |
| Weight (Approximately) | 18.0 g | 20.0 g | 20.0 g |
| Contact Arrangement | 1c (1 Form C) x 2 | 1a, 1c (1 Form A, C) | 1a, 1c (1 Form A, C) |
| Contact Rating (A) | 30A 1Hr | 30A | 50A |
| Expected Life of Load Example | 28 VDC 12 A Motor Lock 100 x 10 ³ ops. <Wide Gap Type> •Maximum Break Rating Motor Lock Load 32 V, 14 A | 14 VDC 115 W Halogen Lamp 100 x 10 ³ ops. 28 VDC 12 A Motor Lock 200 x 10 ³ ops. | 14 VDC 40 A Resistive Load 200 x 10 ³ ops. 14 VDC Inrush 40 A Break 4 A Motor Free 200 x 10 ³ ops. 14 VDC 40 A Motor Lock 100 x 10 ³ ops. |
| Coil Voltage (DC) | 24 V | 6 to 24 V | 12 V |
| Nominal Power (DC) | 1.5 W | 0.6 W/2.0 W | 0.87 W |
| Dielectric Strength | Open Contacts | 500 VAC | 500 VAC |
| | Coil and Contacts | 500 VAC | 500 VAC |
| Packing Style | • Tube Carrier | • Tube Carrier available | • Tube Carrier available |
| Remarks | • Plastic Sealed Type | • Plastic Sealed Type available (* 21.3 x 23.7 x 19.7) | • Plastic Sealed Type |
| Page | 329 | 337 | 343 |

SELECTION TABLE


Solid State Relays

Solid State I/O Modules

| Series Name | SJ | | SE | SN | | | | |
|------------------------------------|---|------------|--|--|------------------|-----------------|------------------|------------|
| Overview |  | |  |  | | | | |
| W x L x H (mm) | 10.0 x 20.0 x 12.8 | | 5.0 x 20.0 x 17.0 | 5.0 x 20.0 x 17.0 | | | | |
| Weight (Approximately) | 5.5 g | | 4.0 g | 3.5 g | | | | |
| Type | — | | — | Input Module | | Output Module | | |
| Type Voltage (Color) | AC (Black) | DC (Green) | AC (Black) | AC (Yellow) | DC (White) | AC (Black) | DC (Red) | |
| Type of Current | 1 A | | 1.5 A | — | | 1 A | | |
| Input Side | Nominal Voltage | | 3, 5, 12, 24 VDC | 5, 12, 24 VDC | 3, 5, 12, 24 VDC | 5, 12, 24 VDC | 3, 5, 12, 24 VDC | |
| | Impedance | 3 V | 120 W | — | 100 VAC | 12, 24 VDC | 180 W | — |
| | | 5 V | 360 W | 430 W | — | — | 390 W | — |
| | | 12 V | 1.0 kW | 1.2 kW | — | — | 1.2 kW | — |
| | | 24 V | 2.0 kW | 2.4 kW | — | — | 2.7 kW | 2.4 kW |
| Output Side | Load Voltage Range | | 24 to 265 Vrms | 3 to 30 VDC | 4 to 6 VDC | | 24 to 265 Vrms | |
| | Max. Load Current | | 1.0 A rms | 1.0 A | ±0.4mA (VDD=5V) | ±0.4mA (VDD=5V) | 1.0 A rms | 1.0 A |
| | Min. Load Current | | 10 mA rms | 1 mA | — | — | 10 mA rms | 1 mA |
| | 1 Cycle Surge Current | | 50 A | 3 A (10 ms) | — | — | 50 A | 3 A (10ms) |
| | Max. Off-state Leakage Current | | 0.75/1.5 mA rms | 0.1 mA | — | — | 1.5/3.0 mA rms | 0.1 mA |
| Max. On-state Voltage Drop | | 1.2 V rms | 1.2 V | — | — | 1.2 Vrms | 1.2 V | |
| Max. Operate Time | 1ms | | 1 ms | 25 ms | 10 ms | 1 ms | | |
| Max. Release Time | 1/2 cycle + 1 ms | 1 ms | 1/2 cycle + 1 ms | 30 ms | 10 ms | 1/2 cycle + 1ms | 1 ms | |
| Dielectric Strength (Input-Output) | 2,500 V rms | | 2,500 V rms | 2,500 Vrms | | | | |
| Operating Temperature Range | -30°C to +85°C | | -30°C to +85°C | -30°C to +85°C | | | | |
| Storage Temperature Range | -40°C to +100°C | | -40°C to +100°C | -40°C to +100°C | | | | |
| Safety Standards | UL, CSA | | — | — | | | | |
| Packing style | • Tube Carrier | | • Tube Carrier | • Tube Carrier | | | | |
| Remarks | <ul style="list-style-type: none"> Compatible with JY Types relay Internal surge absorber Socket available | | <ul style="list-style-type: none"> Internal zero cross circuit available Internal surge absorber | <ul style="list-style-type: none"> Compatible with NY Type relay Internal surge absorber Socket available | | | | |
| Page | 347 | | 353 | 357 | | | | |

RELAYS-NOTES ON

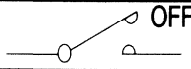
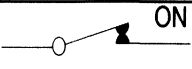
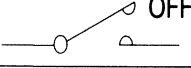



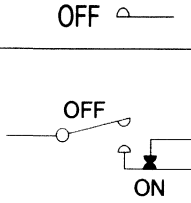
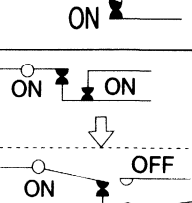
- The technical terms used in the relay selection table are explained below.

| SELECTION TABLE | |
|------------------------------------|---|
| Series Name | FBR620 |
| Overview |  |
| W x L x H (mm) | 12.6 x 28.7 x 24.7 |
| Weight (Approximately) | 16.0 g |
| Contact Arrangement | 2a, 2b, 2c (2 Form A, B, C) |
| Contact Rating (A) | (7A carrying) 5A |
| Minimum Switching Load (ref.) | 5VDC 100mA |
| Contact Rating (Resistive Load) | 30 VDC/240 VAC 5 A |
| Coil Voltage (DC) | 5 to 60 V |
| Nominal Power (DC) | 0.5 W |
| Dielectric Strength | Open Contacts |
| | Coil and Contacts |
| Surge Strength (Coil and Contacts) | 1,000 VAC |
| Expected Life | Mechanical |
| | Electrical (Rated Load) |
| Safety Standards | 10,000 V |
| Packing Style | 20 x 10 ⁶ ops. |
| Remarks | 100 x 10 ³ ops. (DC) 200 x 10 ³ ops. (AC) |
| | • Plastic sealed type available |
| Page | UL, CSA |
| | — |
| | 210 |

Contact arrangement

Refers to circuit configuration of contact incorporated into one relay and operation mode of contact when voltage (current) applied to coil.

[Example]

| Symbol \ State | Non-energized | Energized |
|---------------------------------|--|---|
| 1a NO 1 form A (1 make) |  OFF |  ON |
| 1b NC 1 form B (1 break) |  OFF |  ON |
| 1c T 1 form C (1 transfer) |  ON |  OFF |
| 1MBB D 1 form D (continuous) |  OFF |  ON |

Contact rating range

Rated carrying current:

Denotes typical current that can flow continuously through closed contacts.

Rated switching current:

Denotes typical current that can turn contact on and off with connected load.

Minimum switching load (reference value)

Denotes typical minimum load used when switching resistance under normal environmental conditions (normal temperature, normal humidity, clean environment). Note that the minimum switching load changes depending on the usage frequency and the environment.

Contact rating

Denotes typical power, voltage or current, that can turn contact on and off. Usually, the contact rating refers to the resistance load.

Coil voltage

Denotes range of rated coil voltages provided for the relay series.

Nominal power

Denotes power dissipated by coil at rated coil voltage.

DC coil voltage:

Nominal power (W)

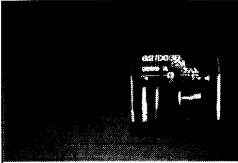
$$= \text{rated voltage (V)} \times \text{rated current (A)}$$

AC coil voltage:

Nominal power (VA)

$$= \text{rated voltage (V)} \times \text{rated current (A)}$$

RELAYS-NOTES ON

| SELECTION TABLE | | | | | | | | | | | | | | | |
|----------------------------------|--|-----|--|----|--|----|---------------|-----|-------|------|--|---|--|---|--|
| Series Name | FBR620 | | | | | | | | | | | | | | |
| Outview |  | | | | | | | | | | | | | | |
| W x L x H (mm) | | | | | | | | | | | | | | | |
| Weight (Approximately) | 16.0 g | | | | | | | | | | | | | | |
| Contact Arrangement | 2a, 2b, 2c (2 Form A, B, C) | | | | | | | | | | | | | | |
| Contact Rating (A) | <table border="1"> <tr><td>30</td><td></td></tr> <tr><td>20</td><td></td></tr> <tr><td>10</td><td>(7A carrying)</td></tr> <tr><td>5</td><td></td></tr> <tr><td>3</td><td></td></tr> <tr><td>2</td><td></td></tr> <tr><td>1</td><td></td></tr> </table> | 30 | | 20 | | 10 | (7A carrying) | 5 | | 3 | | 2 | | 1 | |
| 30 | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | |
| 10 | (7A carrying) | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | |
| Minimum Applicable Load (ref.) | <table border="1"> <tr><td>100</td><td></td></tr> <tr><td>10</td><td></td></tr> <tr><td>1</td><td>5VDC</td></tr> <tr><td>0.1</td><td>100mA</td></tr> <tr><td>0.01</td><td></td></tr> </table> | 100 | | 10 | | 1 | 5VDC | 0.1 | 100mA | 0.01 | | | | | |
| 100 | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | |
| 1 | 5VDC | | | | | | | | | | | | | | |
| 0.1 | 100mA | | | | | | | | | | | | | | |
| 0.01 | | | | | | | | | | | | | | | |
| Contact Rating (Resistive Load) | 30 VDC/240 VAC 5 A | | | | | | | | | | | | | | |
| Coil Voltage (DC) | 5 to 60 V | | | | | | | | | | | | | | |
| Nominal Power (DC) | 0.5 W | | | | | | | | | | | | | | |
| Dielectric Strength | Open Contacts | | | | | | | | | | | | | | |
| | Coil and Contacts | | | | | | | | | | | | | | |
| Surge Strength (Coil to Contact) | | | | | | | | | | | | | | | |
| Expected Life | Mechanical | | | | | | | | | | | | | | |
| | Electrical (Rated Load) | | | | | | | | | | | | | | |
| Safety Standards | UL, CSA | | | | | | | | | | | | | | |
| Packing Style | — | | | | | | | | | | | | | | |
| Remarks | • Plastic sealed type available | | | | | | | | | | | | | | |
| Page | 210 | | | | | | | | | | | | | | |

Dielectric strength

Denotes maximum voltage that can be applied between coil and contact or between pair of open contacts for 1 minute without causing dielectric breakdown.

Surge Voltage

Denotes the peak value of pulse voltage that can be applied between coil and contact without causing dielectric breakdown.

Service life

Mechanical service life:

Denotes service life of relay operated at rated coil voltage (current) without load.

Electrical service life:

Denotes service life of relay operated at rated coil voltage (current) with rated contact load connected to relay switching contact.

Safety standards

Standard for preventing electric shock hazards and fire accidents differ from country-to-country.

| | |
|--------|-------------|
| UL: | USA |
| CSA: | Canada |
| VDE: | Germany |
| SEV: | Switzerland |
| SEMKO: | Sweden |
| DEMKO: | Denmark |
| FIMKO: | Finland |
| NEMKO: | Norway |
| IMQ: | Italy |
| ÖVE: | Austria |
| BSI: | U.K. |

RELAYS-NOTES ON

FBR10 SERIES

■ SPECIFICATIONS

| Item | | |
|-----------------------|---|---------------------------|
| Contact | Arrangement and Style | |
| | Material | |
| | Resistance (initial) | |
| | Rating (resistive) | |
| | Maximum Carrying Current | |
| | Maximum Switching Power | |
| | Maximum Switching Voltage* ¹ | |
| | Maximum Switching Current | |
| | Minimum Switching load* ² | |
| | Electrostatic Capacity (Reference) | |
| Coil | Nominal power (at 20°C) | |
| | Operate power (at 20°C) | |
| | Thermal Resistance at Continuous Thermal load | |
| | Operating Temperature | |
| | Operating Humidity | |
| Time Value | Operate (at nominal voltage) | |
| | Release (at nominal voltage) | |
| | Maximum Switching Frequency | |
| Insulation | Resistance (initial) | |
| | Dielectric Strength | Between coil and contacts |
| | | Between open contacts |
| | Surge Strength | Between coil and contacts |
| Between open contacts | | |
| Life | Mechanical | |
| | Electrical (Refer to the REFERENCE DATA) | DC |
| | | AC |
| Other | Vibration Resistance | |
| | Shock Resistance | Misoperation |
| | | Endurance |
| | Weight | |

Contact arrangement

The contact arrangement that the series of relays (FBR10 series relays in this example) have is described.

See Contact Arrangement on page 3 for the operation mode of each contact.

Contact style

For improvement of contact reliability, at least one of a pair of contact is composed of bifurcated spring and each bifurcated spring is attached contact piece, which is called "bifurcated contact." In addition, the contact without bifurcated spring is called "single contact."

Bifurcated contact type is available in signal relay series, which is suitable for low level signal switching.

Contact material

The contacts are fastened or welded to a movable leaf spring and stationary terminal to ensure electrical contact. Usually, they are made of materials consisting mainly of silver with excellent electrical and thermal conductivity.

For small current loads, gold-plated silver contacts are generally used.

Contact resistance

The contact resistance is the resistance across the closed contacts of the relay.

To measure the contact resistance, the potential drop generated at the contacts when current flows is read and converted to the resistance (potential-drop method).

Usually, the contact resistance is measured at the relay terminals, and includes the resistance of other conductive elements.

The contact resistance varies with the contact material and measuring current. The standard silver contacts with higher contact resistance cause a low measuring current.

This phenomenon is attributed to the high-resistance sulfide film on the silver contact which cannot be broken down by a low current, but which is broken down by a large current.

Contact rating

This criterion for switching performance is expressed by rated voltage, rated current and types of load.

Electrostatic capacity

This is decisive in evaluating HF suitability of a relay contact.

Operating temperature range

This refers to the ambient temperature range within the relay can operate without affecting its characteristics or functions.

Note that increased ambient temperature increases the relay pickup voltage and decreases the allowable coil voltage.

Operating humidity range

This refers to the ambient humidity range within the relay can operate without affecting its characteristics or functions.

RELAYS-NOTES ON

FBR10 SERIES

■ SPECIFICATIONS

| Item | | |
|-----------------------|---|---------------------------|
| Contact | Arrangement and Style | |
| | Material | |
| | Resistance (initial) | |
| | Rating (resistive) | |
| | Maximum Carrying Current | |
| | Maximum Switching Power | |
| | Maximum Switching Voltage* ¹ | |
| | Maximum Switching Current | |
| | Minimum Switching load* ² | |
| | Electrostatic Capacity (Reference) | |
| Coil | Nominal power (at 20°C) | |
| | Operate power (at 20°C) | |
| | Thermal Resistance at Continuous Thermal Load | |
| | Operating Temperature | |
| | Operating Humidity | |
| Time Value | Operate (at nominal voltage) | |
| | Release (at nominal voltage) | |
| | Maximum Switching Frequency | |
| Insulation | Resistance (initial) | |
| | Dielectric Strength | Between coil and contacts |
| | | Between open contacts |
| | Surge Strength | Between coil and contacts |
| Between open contacts | | |
| Life | Mechanical | |
| | Electrical (Refer to the REFERENCE DATA) | DC |
| | | sAC |
| Other | Vibration Resistance | |
| | Shock Resistance | Misoperation |
| | | Endurance |
| | Unit Mass | |

Maximum carrying current

This is the maximum current that can be carried to contacts when the rated voltage is applied to coil at an ambient temperature of 20°C.

Maximum switching power

This is the maximum power that can be switched by contacts.

Maximum switching voltage

This is the maximum voltage that can be switched by contacts. Accordingly, the switching current must be limited referring to the maximum switching power.

Maximum switching current

This is the maximum current that can be switched by contacts. Accordingly, the switching voltage must be limited referring to the Max. Switching Power.

Thermal resistance

This is the temperature rise in Kelvin per watt due to thermal coil dissipation (without contribution of contact dissipation).

Operating time

This is the time required for making (or breaking) contact to close (or open) after voltage is applied to the coil. Namely, it is the delay time between input and output.

The operating time may not include the bounce time. Bounce is the contact rebound after closing or opening which momentarily opens the contact.

Release Time

This is the time required for making (or breaking) contact to open (or close) after the coil voltage of the operating relay is disconnected. The release time may not include the bounce time.

Maximum switching frequency

This is the maximum number of fully completed switching cycles per second.

Insulation resistance

This refers to the resistance offered by the insulator between conductive elements. Usually, a high voltage (usually 500 VDC or so) is applied across the insulation between non-conductive elements, and the leakage current is measured and converted to the resistance.

Vibration resistance and shock resistance

This refers to the durability against vibration or shock during transport of relays or during operation of relays in various equipment.

The durability against vibration or shock is the level at which the characteristics or functions of a relay are not affected by vibration or shock.

The faulty operation due to vibration or shock is the level at which faulty operation (or chattering where closed contacts are interrupted instantaneously) occurs.

RELAYS-NOTES ON

Nominal voltage

This refers to the optimum voltage to be applied to the coil for relay operation. The relay can operate perfectly at the rated coil voltage within the operating temperature range given in the separate table.

Coil resistance

This is the DC resistance of the relay coil. Usually, the coil resistance varies over a range of $\pm 10\%$ to $\pm 15\%$ after the completion of winding, owing to dispersion of the coil wire diameter (polyurethane-insulated copper wire).

The coil resistance in the catalog refers to the value measured at an ambient temperature of 20°C (room temperature). With increases in the ambient temperature, the coil resistance increases because copper wire has a positive temperature coefficient. The coil resistance at an ambient temperature of T (°C) can be calculated from the following expression.

$$R_T = R_{20} \{1 + \alpha (T - 20)\}$$

where,

R_T : coil resistance at ambient temperature of T (°C)

R_{20} : coil resistance at ambient temperature of 20 (°C) (in catalog)

α : temperature coefficient of copper wire (0.00393)

Nominal current

This is the current flowing through the coil when the nominal voltage is applied to the coil.

The nominal current can be calculated from the following expression.

$$I \text{ (nominal current) } = \frac{V \text{ (nominal voltage)}}{R \text{ (coil resistance)}}$$

COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance ($\pm 10\%$) | Nominal current (at nominal voltage) Approx. | Must operate voltage | Must release voltage | Nominal power | Operate power | Coil temperature rise |
|-----------|-------------|-----------------|--------------------------------|--|-----------------------------|-----------------------------|-------------------------------------|--------------------|-------------------------------------|
| Standard | -P type | | | | | | | | |
| FBR12ND03 | FBR12ND03-P | 3 VDC | 65 Ω | 46 mA | 75% max. of nominal voltage | 10% min. of nominal voltage | Approx. 140 mW (at nominal voltage) | Approx. 80 mW Max. | Approx. 18 deg (at nominal voltage) |
| FBR12ND04 | FBR12ND04-P | 4.5 VDC | 145 Ω | 31 mA | | | | | |
| FBR12ND05 | FBR12ND05-P | 5 VDC | 178 Ω | 28 mA | | | | | |
| FBR12ND06 | FBR12ND06-P | 6 VDC | 257 Ω | 23 mA | | | | | |
| FBR12ND09 | FBR12ND09-P | 9 VDC | 579 Ω | 15 mA | | | | | |
| FBR12ND12 | FBR12ND12-P | 12 VDC | 1,028 Ω | 11 mA | | | | | |
| FBR12ND24 | FBR12ND24-P | 24 VDC | 2,880 Ω | 8 mA | | | | | |

Operate voltage (Pick-up voltage)

When the coil voltage is gradually increased from 0 V, the relay will operate at a certain coil voltage. This voltage is called the operate voltage.

In DC-type relays, the operate voltage is usually less than 70% (or 80%) of the nominal voltage. With increases in the ambient temperature, the coil resistance increases, and the relay operate voltage increases.

The operate voltage at an ambient temperature of T (°C) can be calculated from the following expression.

$$V_{OP}(T) = V_{OP}(20) \{1 + \alpha (T - 20)\}$$

where,

$V_{OP}(T)$: operate voltage at ambient temperature of T (°C)

$V_{OP}(20)$: operate voltage at ambient temperature of 20 (°C)

α : temperature coefficient of copper wire (0.00393)

RELAYS-NOTES ON

Release voltage (Drop-out voltage)

When the voltage is gradually decreased after the relay operates at the nominal voltage, it decreases substantially to release the relay. This coil voltage is called the release voltage.

Nominal power

This is the power consumption of a specific coil when the nominal voltage is applied at an ambient temperature of 20°C. It can be calculated from the following expression.

$$W \text{ (power consumption)} = \frac{V^2 \text{ (nominal voltage)}^2}{R \text{ (coil resistance)}}$$

Operate power

This is the power consumption of a specific coil when the operate voltage is applied at an ambient temperature of 20°C. It can be calculated from the following expression.

$$W \text{ (power consumption)} = \frac{V^2 \text{ (operate voltage)}^2}{R \text{ (coil resistance)}}$$

COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance (±10%) | Nominal current (at nominal voltage) Approx. | Must operate voltage | Must release voltage | Nominal power | Operate power | Coil temperature rise |
|-----------|-------------|-----------------|------------------------|--|-----------------------------|-----------------------------|-------------------------------------|--------------------|-------------------------------------|
| Standard | -P type | | | | | | | | |
| FBR12ND03 | FBR12ND03-P | 3 VDC | 65 Ω | 46 mA | 75% max. of nominal voltage | 10% min. of nominal voltage | Approx. 140 mW (at nominal voltage) | Approx. 80 mW Max. | Approx. 18 deg (at nominal voltage) |
| FBR12ND04 | FBR12ND04-P | 4.5 VDC | 145 Ω | 31 mA | | | | | |
| FBR12ND05 | FBR12ND05-P | 5 VDC | 178 Ω | 28 mA | | | | | |
| FBR12ND06 | FBR12ND06-P | 6 VDC | 257 Ω | 23 mA | | | | | |
| FBR12ND09 | FBR12ND09-P | 9 VDC | 579 Ω | 15 mA | | | | | |
| FBR12ND12 | FBR12ND12-P | 12 VDC | 1,028 Ω | 11 mA | | | | | |
| FBR12ND24 | FBR12ND24-P | 24 VDC | 2,880 Ω | 8 mA | | | 200 mW | 112 mW | 30 deg |

Coil temperature rise

When voltage is applied to the relay coil, the coil resistance and current flowing through the coil cause the coil to generate heat. The rising coil temperature is called the coil temperature rise.

The value in the catalog is the coil temperature increase when the nominal voltage is applied at an ambient temperature of 20°C.

Generally, the lower the coil power consumption, the lower the coil temperature rise.

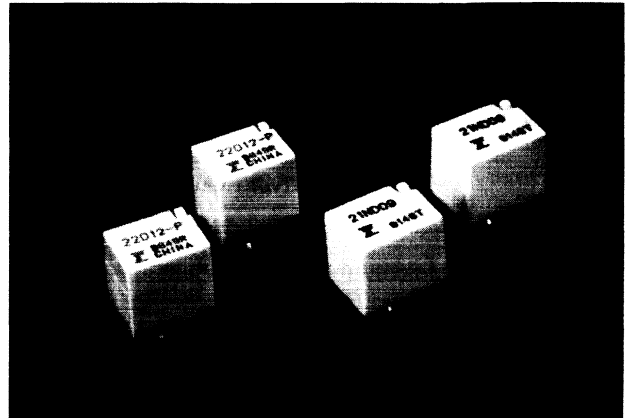
MINIATURE RELAY

1 POLE—1 to 2 A (FOR SIGNAL SWITCHING)

FBR20 SERIES

■ FEATURES

- Microminiature size
Two FBR20 Series relays can be mounted in the space required for a single FBR210 Series relay.
- 2 A carrying current
- Strong shock resistance
Even with 500 m/s² shock, FBR20 Series relays never miss an operation.
- Easy pattern design
Separate location of drive (coil) and output (contact) terminals allows easy PC board pattern design.
- Formed terminals for temporary mounting
The uniquely designed terminals allow FBR20 Series relays to be mounted temporarily on PC boards.
- Conforms to FCC68.302 (high dielectric strength type)
- UL recognized (File No. E63615)
- Tube packaging



■ ORDERING INFORMATION

[Example] FBR21 N D12 U - P (-02)
 (a) (b) (c) (d) (e) (f)

| | | |
|-----|--------------------------------|--|
| (a) | Series Name (Contact Style) | FBR21: FBR20 Series (single contact) FBR22: FBR20 Series (bifurcated contact) |
| (b) | Enclosure | Nil: Flux free type N: Plastic sealed type |
| (c) | Nominal Voltage | (Example) D03: 3 VDC D05: 5 VDC D12: 12 VDC (refer to the COIL DATA CHART) |
| (d) | UL Standard | Nil: Standard U: UL114 recognized |
| (e) | Contact Material | P: Gold-overlay silver-palladium |
| (f) | Special Type | Nil: Standard 02: High dielectric strength type |

Note: The designation name is stamped on the top of the relay case as follows:
(Example) Designation ordered: FBR22D12-P
Stamp: 22D12-P

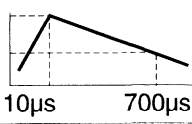
FBR20 SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL114 (File No. E63615)

| Nominal voltage | Contact rating |
|-----------------|---|
| 1.5 to 24 VDC | 1 A 24 VDC resistive 0.5 A 120 VAC resistive |

■ SPECIFICATIONS

| Item | | Single contact type | Bifurcated contact type | |
|---|--|--|---|--|
| Contact | Arrangement | 1 form C (SPDT) | | |
| | Material | Gold-overlay silver-palladium | | |
| | Resistance (initial) | Maximum 100 mΩ (at 0.1 A 6 VDC) | | |
| | Rating (resistive) | 0.5 A 120 VAC or 1 A 24 VDC (resistive load) | | |
| | Maximum Carrying Current | 2 A | | |
| | Maximum Switching Power | 60 VA or 24 W | | |
| | Maximum Switching Voltage* ¹ | 125 V | | |
| | Maximum Switching Current | 1 A | | |
| | Minimum Switching Load* ² (reference) | Plastic sealed 1 mA 1 VDC Flux free 1 mA 5 VDC | Plastic sealed 0.1 mA 0.1 VDC Flux free 1 mA 1 VDC | |
| | Capacitance (reference) | Approximately 2 pF (between coil and contacts) Approximately 1 pF (between open contacts) | | |
| Coil | Nominal Power (at 20°C) | Approximately 0.3 W | | |
| | Operate Power (at 20°C) | Approximately 0.192 W maximum | | |
| | Operating Temperature | -30°C to +65°C (no frost) (refer to the CHARACTERISTIC DATA) | | |
| | Operating Humidity | 45 to 85%RH | | |
| Time Value | Operate (at nominal voltage) | Maximum 5 ms | | |
| | Release (at nominal voltage) | Maximum 2 ms | | |
| Insulation | Resistance (initial) | Minimum 100 MΩ (at 500 VDC) | | |
| | Dielectric Strength | Between coil and contacts | 500 VAC for 1 minute (standard) 1,000 VAC for 1 minute (high dielectric strength type) | |
| | | Between open contacts | 500 VAC 1 minute | |
| Surge Strength (high dielectric strength) | 1,500 V (10 x 700 μs) |  | | |
| Life | Mechanical | 5 x 10 ⁶ operations minimum | | |
| | Electrical (refer to the REFERENCE DATA) | 200 x 10 ³ operations minimum (at contact rating) | | |
| Other | Vibration Resistance | 10 to 300 Hz (double amplitude of 3.0 mm) | | |
| | Shock Resistance | Misoperation | 500 m/s ² (11± ¹ ms) | |
| | | Endurance | 1,000 m/s ² (11± ¹ ms) | |
| Weight | Approximately 1.7 g | | | |

*¹ If the switching voltage exceeds the rated contact voltage, reduce the current. The current values vary according to the type of load.

*² Values when switching a resistive load at normal room temperature and humidity, and in a clean environment. The minimum switching load varies with the switching frequency and operation environment.

FBR20 SERIES

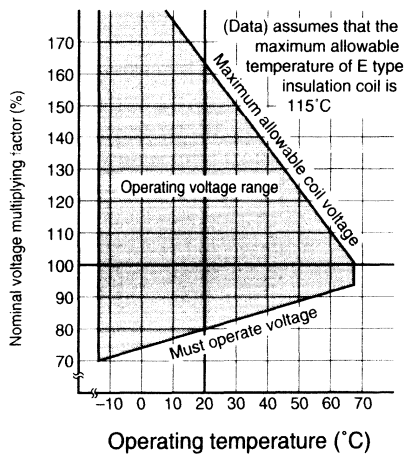
COIL DATA CHART

| MODEL | | | | Nominal voltage | Coil resistance $\pm 10\%$ | Nominal current (at nominal voltage) approx. | Must operate voltage | Must release voltage | Maximum allowable voltage | Nominal power | Coil temperature rise |
|---------------------|----------------|-------------------------|----------------|-----------------|----------------------------|--|-----------------------------|----------------------------|---------------------------|-------------------------------------|-------------------------------------|
| Single contact type | | Bifurcated contact type | | | | | | | | | |
| Flux free | Plastic sealed | Flux free | Plastic sealed | | | | | | | | |
| FBR21D01-P | FBR21ND01-P | FBR22D01-P | FBR22ND01-P | 1.5 VDC | 7.5 Ω | 200 mA | 80% max. of nominal voltage | 5% min. of nominal voltage | 160% of nominal voltage | Approx. 300 mW (at nominal voltage) | Approx. 45 deg (at nominal voltage) |
| FBR21D03-P | FBR21ND03-P | FBR22D03-P | FBR22ND03-P | 3 VDC | 30 Ω | 100 mA | | | | | |
| FBR21D05-P | FBR21ND05-P | FBR22D05-P | FBR22ND05-P | 5 VDC | 83 Ω | 60 mA | | | | | |
| FBR21D06-P | FBR21ND06-P | FBR22D06-P | FBR22ND06-P | 6 VDC | 120 Ω | 50 mA | | | | | |
| FBR21D09-P | FBR21ND09-P | FBR22D09-P | FBR22ND09-P | 9 VDC | 270 Ω | 33 mA | | | | | |
| FBR21D12-P | FBR21ND12-P | FBR22D12-P | FBR22ND12-P | 12 VDC | 480 Ω | 25 mA | | | | | |
| FBR21D18-P | FBR21ND18-P | FBR22D18-P | FBR22ND18-P | 18 VDC | 1,080 Ω | 17 mA | | | | | |
| FBR21D24-P | FBR21ND24-P | FBR22D24-P | FBR22ND24-P | 24 VDC | 1,920 Ω | 12.5 mA | | | | | |

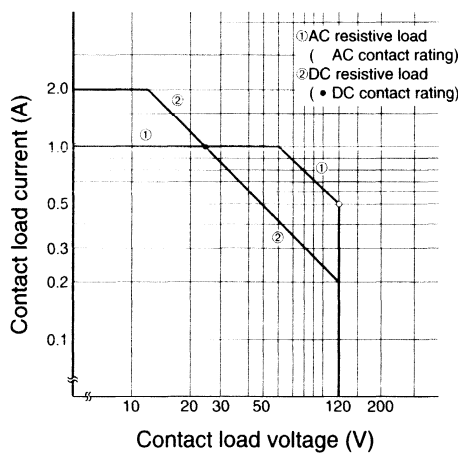
Note: All values in the table are measured at 20°C.

CHARACTERISTIC DATA

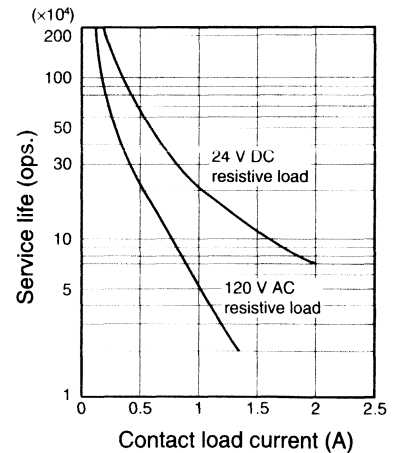
Range of operation temperature and voltage



Maximum switching capacity

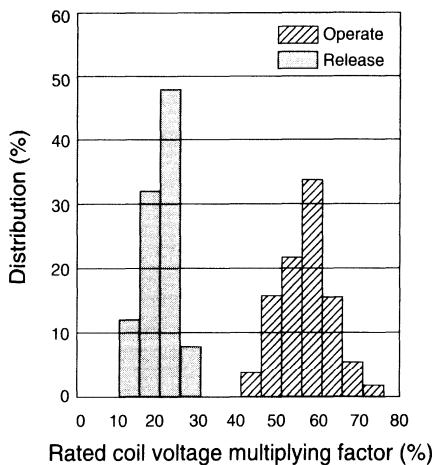


Life curve

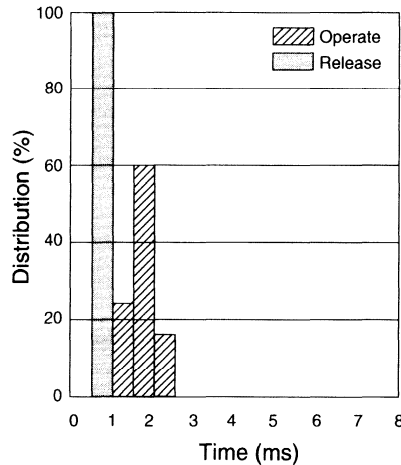


REFERENCE DATA

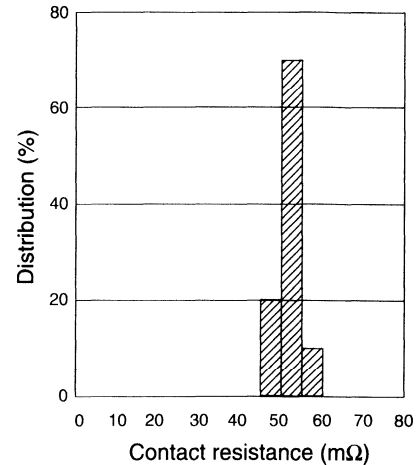
Distribution of operate and release voltage



Distribution of operate and release time



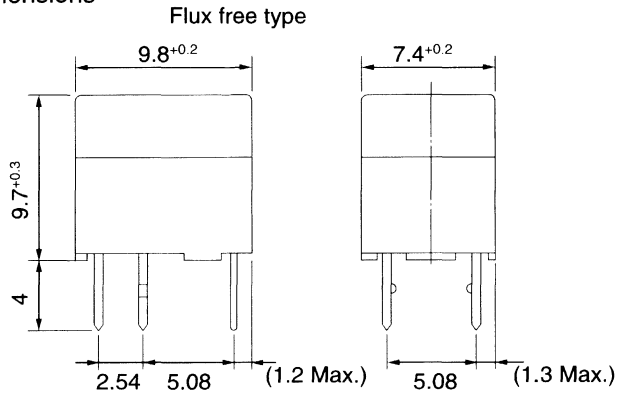
Distribution of contact resistance



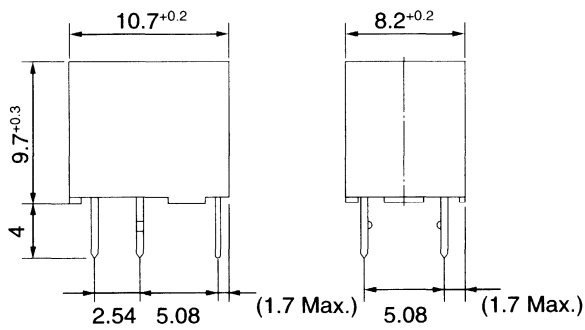
FBR20 SERIES

■ DIMENSIONS

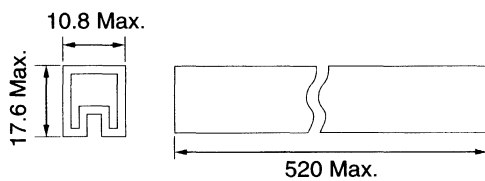
●Dimensions



Plastic sealed type

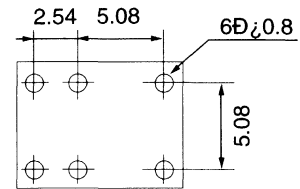


●Tube carrier

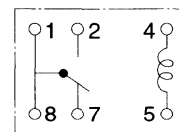


Flux free type:50pcs/Tube
Plastic sealed type:40pcs/Tube

●PC board mounting hole layout (BOTTOM VIEW)



●Schematics (BOTTOM VIEW)



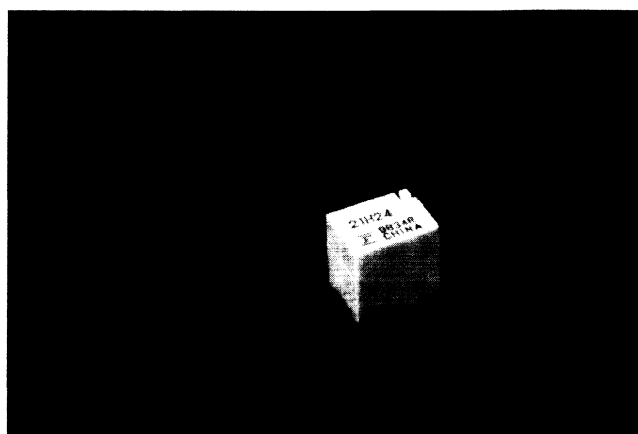
Unit: mm

MINIATURE RELAY

1 POLE—1 to 2 A (FOR SIGNAL SWITCHING) FBR20H SERIES

■ FEATURES

- Low power consumption
High efficiency electromagnetic circuit saves power consumption.
Nominal power consumption: 200 mW
Operate power consumption: 112 mW
- Strong shock resistance
Even with 500 m/s² shock, FBR20H Series relays never miss an operation.
- High dielectric strength type available (conforms to FCC68.302)
Dielectric strength between coil-contact:
AC 1,000 V
Surge strength between coil-contact: 1,500 V
- Easy pattern design
Separate location of drive (coil) and output (contact) terminals allows easy PC board pattern design.
- Formed terminals for temporary mounting
The specially designed terminals allow FBR20H Series relays to be mounted temporarily on PC boards.
- UL recognized (File No. E63615)
- Tube packaging



■ ORDERING INFORMATION

[Example] $\frac{\text{FBR21}}{\text{(a)}} \frac{\text{N}}{\text{(b)}} \frac{\text{H12}}{\text{(c)}} \frac{\text{U}}{\text{(d)}} - \frac{\text{P}}{\text{(e)}} \frac{\text{(-02)}}{\text{(f)}}$

| | | |
|-----|--------------------------------|--|
| (a) | Series Name (Contact Style) | FBR21: FBR20H Series (single contact) FBR22: FBR20H Series (bifurcated contact) |
| (b) | Enclosure | Nil: Flux free type N: Plastic sealed type |
| (c) | Nominal Voltage | (Example) H03: 3 VDC H05: 5 VDC H12: 12 VDC (refer to the COIL DATA CHART) |
| (d) | UL Standard | No designation: standard U: UL114 recognized |
| (e) | Contact Material | P: Gold-overlay silver-palladium |
| (f) | Special Type | Nil: Standard 02: High dielectric strength type |

Note: The designation name is stamped on the top of the relay case as follows:
(Example) Designation ordered: FBR21H05-P
Stamp: 21H05-P

FBR20H SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL114 (File No. E63615)

| Nominal voltage | Contact rating |
|-----------------|---|
| 1.5 to 24 VDC | 1 A 24 VDC resistive 0.5 A 120 VAC resistive |

■ SPECIFICATIONS

| Item | | Single contact type | Bifurcated contact type | |
|--|--|---|---|--|
| Contact | Arrangement | 1 form C (SPDT) | | |
| | Material | Gold-overlay silver-palladium | | |
| | Resistance (initial) | Maximum 100 mΩ (at 0.1 A 6 VDC) | | |
| | Rating (resistive) | 0.5 A 120 VAC or 1 A 24 VDC (resistive load) | | |
| | Maximum Carrying Current | 2 A | | |
| | Maximum Switching Power | 60 VA or 24 W | | |
| | Maximum Switching Voltage* ¹ | 125 V | | |
| | Maximum Switching Current | 1 A | | |
| | Minimum Switching Load* ² (reference) | Plastic sealed 1 mA 1 VDC Flux free 1 mA 5 VDC | Plastic sealed 0.1 mA 0.1 VDC Flux free 1 mA 1 VDC | |
| | Capacitance (reference) | Approximately 2 pF (between coil and contact) Approximately 1 pF (between open contacts) | | |
| Coil | Nominal Power (at 20°C) | Approximately 0.2 W to 0.25 W (24 V coil) | | |
| | Operate Power (at 20°C) | Approximately 0.112 W to 0.14 W maximum (24 V coil) | | |
| | Operating Temperature | -30°C to +70°C (no frost) (refer to the CHARACTERISTIC DATA) | | |
| | Operating Humidity | 45 to 85%RH | | |
| Time Value | Operate (at nominal voltage) | Maximum 5 ms | | |
| | Release (at nominal voltage) | Maximum 2 ms | | |
| Insulation | Resistance (initial) | Minimum 100 MΩ (at 500 VDC) | | |
| | Dielectric Strength | between coil and contacts | 500 VAC 1 minute (standard) 1,000 VAC 1 minute (high dielectric strength type) | |
| | | between open contacts | 500 VAC 1 minute | |
| Surge Strength (high dielectric strength type) | 1,500 V (10 x 700 μs) | | | |
| Life | Mechanical | 5 x 10 ⁶ operations minimum | | |
| | Electrical (refer to the REFERENCE DATA) | 200 x 10 ³ operations minimum (at contact rating) | | |
| Other | Vibration Resistance | 10 to 300 Hz (double amplitude of 3.0 mm) | | |
| | Shock Resistance | Misoperation | 500 m/s ² (11± ¹ ms) | |
| | | Endurance | 1,000 m/s ² (11± ¹ ms) | |
| | Weight | Approximately 1.7 g | | |

*¹ If the switching voltage exceeds the rated contact voltage, reduce the current. The current values vary according to the type of load.

*² Values when switching a resistive load at normal room temperature and humidity, and in a clean environment. The minimum switching load varies with the switching frequency and operation environment.

FBR20H SERIES

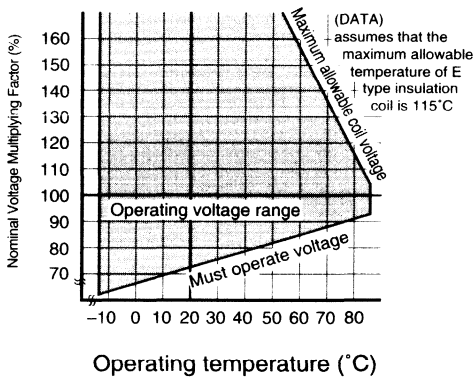
COIL DATA CHART

| MODEL | | | | Nominal voltage | Coil resistance $\pm 10\%$ | Nominal current (at nominal voltage) approx. | Must operate voltage | Must release voltage | Maximum allowable voltage | Nominal power | Coil temperature rise |
|---------------------|----------------|-------------------------|----------------|-----------------|----------------------------|--|-----------------------------|-----------------------------|---------------------------|-------------------------------------|-------------------------------------|
| Single contact type | | Bifurcated contact type | | | | | | | | | |
| Flux free | Plastic sealed | Flux free | Plastic sealed | | | | | | | | |
| FBR21H01-P | FBR21NH01-P | FBR22H01-P | FBR22NH01-P | 1.5 VDC | 11 Ω | 136 mA | 75% max. of nominal voltage | 10% min. of nominal voltage | 200% of nominal voltage | Approx. 200 mW (at nominal voltage) | Approx. 35 deg (at nominal voltage) |
| FBR21H03-P | FBR21NH03-P | FBR22H03-P | FBR22NH03-P | 3 VDC | 45 Ω | 67 mA | | | | | |
| FBR21H05-P | FBR21NH05-P | FBR22H05-P | FBR22NH05-P | 5 VDC | 125 Ω | 40 mA | | | | | |
| FBR21H06-P | FBR21NH06-P | FBR22H06-P | FBR22NH06-P | 6 VDC | 180 Ω | 33 mA | | | | | |
| FBR21H09-P | FBR21NH09-P | FBR22H09-P | FBR22NH09-P | 9 VDC | 405 Ω | 22 mA | | | | | |
| FBR21H12-P | FBR21NH12-P | FBR22H12-P | FBR22NH12-P | 12 VDC | 720 Ω | 17 mA | | | | | |
| FBR21H18-P | FBR21NH18-P | FBR22H18-P | FBR22NH18-P | 18 VDC | 1,620 Ω | 11 mA | | | | | |
| FBR21H24-P | FBR21NH24-P | FBR22H24-P | FBR22NH24-P | 24 VDC | 2,300 Ω | 10 mA | | | | | |

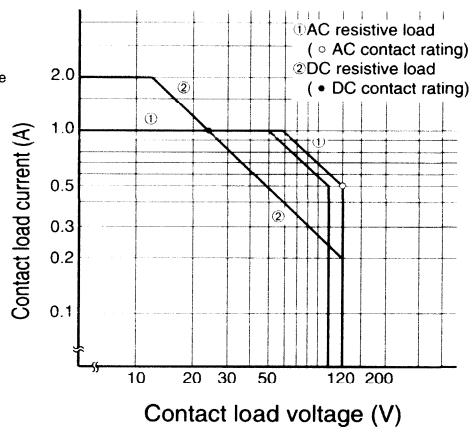
Note: All values in the table are measured at 20°C.

CHARACTERISTIC DATA

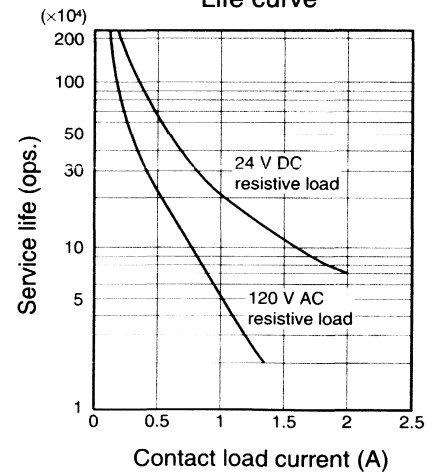
Range of operation temperature and voltage



Maximum switching capacity

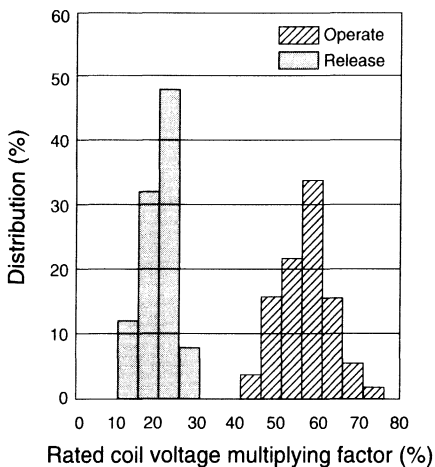


Life curve

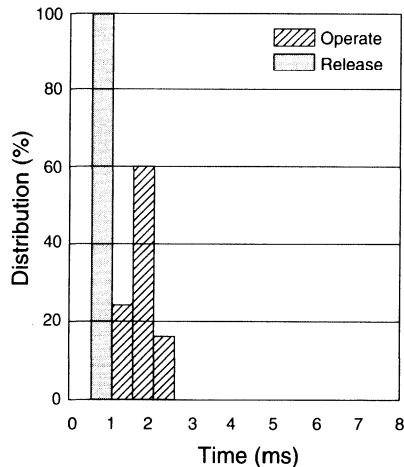


REFERENCE DATA

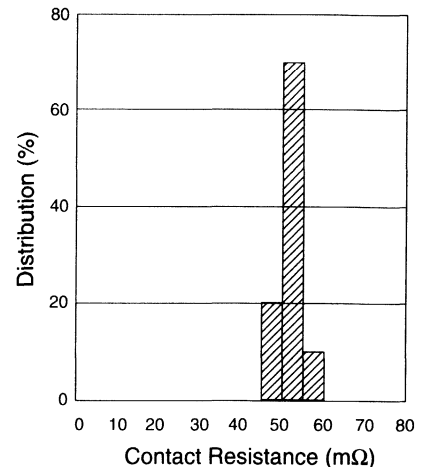
Distribution of Operate & Release Voltage



Distribution of Operate & Release Time



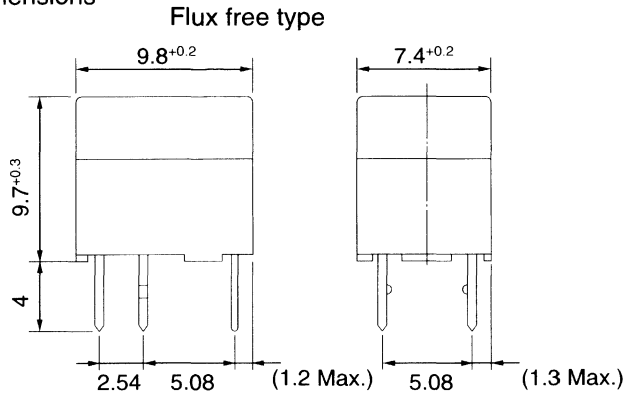
Distribution of Contact Resistance



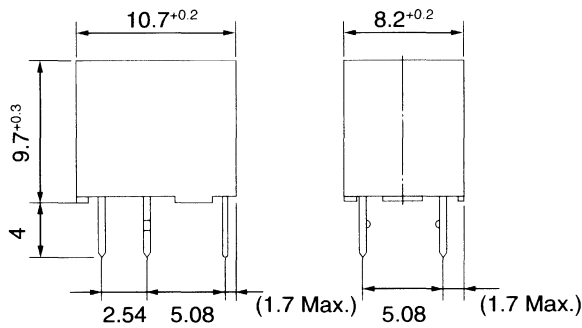
FBR20H SERIES

■ DIMENSIONS

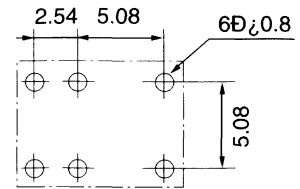
●Dimensions



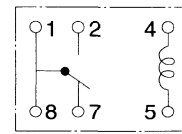
Plastic sealed type



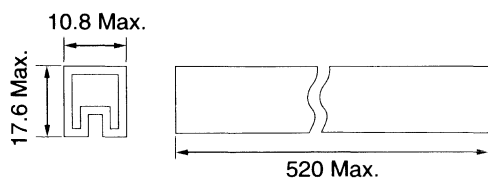
●PC board mounting hole layout (BOTTOM VIEW)



●Schematics (BOTTOM VIEW)



●Tube carrier



Flux free type:50 pcs/Tube
Plastic sealed type:40 pcs/Tube

Unit: mm

MINIATURE RELAY

1 POLE—1 A (FOR SIGNAL SWITCHING)

SY SERIES

■ FEATURES

- Very small size and light weight
- UL, CSA recognized
- Conforms to FCC rules and regulations part 68
 - Dielectric strength 1000 VAC between coil and contacts
 - Surge strength 1500 V
- High sensitivity
- Wide operating range
- DIL pitch terminals
- Plastic sealed type backfilled with nitrogen available
- Dial-pulse relay available



■ ORDERING INFORMATION

[Example] $\frac{SY}{(a)} - \frac{12}{(b)} \frac{W}{(c)} - \frac{K}{(d)}$

| | | |
|-----|-----------------|--|
| (a) | Series Name | SY: SY Series |
| (b) | Nominal Voltage | Refer to the COIL DATA CHART |
| (c) | Contact | Nil: Single type W: Bifurcated type |
| (d) | Enclosure | K: Plastic sealed type |

Note: For movable and stationary contact with gold overlay type, add suffix “-OH”

■ SAFETY STANDARD AND FILE NUMBERS

UL478 (File No. E45026)

C22.2 No. 14 (File No. LR35579)

Please request when the approval markings are required on the cover.

| Nominal voltage | Contact rating |
|-----------------|------------------|
| 1.5 to 24 VDC | 0.5 A 120 VAC |
| | 1 A 24 VDC |
| | 0.15 A 48 VDC |
| | resistive |

SY SERIES

■ SPECIFICATIONS

| Item | | SY-()-K | SY-()W-K | |
|----------------|--------------------------------|--|--|------------------|
| Contact | Arrangement | 1 form C (SPDT) | | |
| | Material | Gold overlay silver alloy | | |
| | Resistance (initial) | Maximum 100 mΩ (at 1 A 6 VDC) | | |
| | Rating (resistive) | 0.5 A 120 VAC or 1 A 24 VDC | 0.5 A 60 VAC or 1 A 24 VDC | |
| | Maximum Carrying Current | 2 A | 1 A | |
| | Maximum Switching Power | 60 VA, 24 W | 30 VA, 24 W | |
| | Maximum Switching Voltage | 120 VAC/60 VDC | | |
| | Maximum Switching Current | 1 A | | |
| | Minimum Switching Load*1 | 1 mA 1 VDC | 0.1 mA 100 mVDC | |
| | Capacitance | Approximately 1.4 pF (between open contacts) Approximately 5.0 pF (between coil and contacts) | | |
| Coil | Nominal Power (at 20°C) | 0.15 to 0.175 W | | |
| | Operate Power (at 20°C) | 0.075 to 0.086 W | | |
| | Operating Temperature | -30°C to +90°C (no frost)/18 V coil: +85°C, 24 V coil: +80°C | | |
| Time Value | Operate (at nominal voltage) | Maximum 5 ms | | |
| | Release (at nominal voltage) | Maximum 2 ms | | |
| Insulation | Resistance | Minimum 1,000 MΩ (at 500 VDC) | Minimum 1,000 MΩ (at 250 VDC) | |
| | Dielectric strength | between open contacts | 400 VAC 1 minute | 300 VAC 1 minute |
| | | between coil and contacts | 1,000 VAC 1 minute | |
| Surge Strength | 1,500 V | | | |
| Life | Mechanical | 5 x 10 ⁶ operations minimum | | |
| | Electrical (at contact rating) | 100 x 10 ³ operations minimum | 100 x 10 ³ operations minimum | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | Shock Resistance | Misoperation | 300 m/s ² (11 ±1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| | Weight | Approximately 1.7 g | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

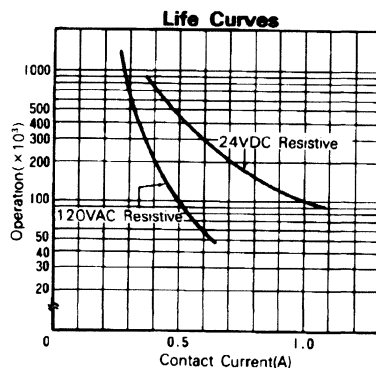
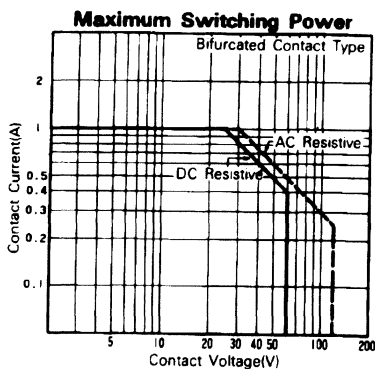
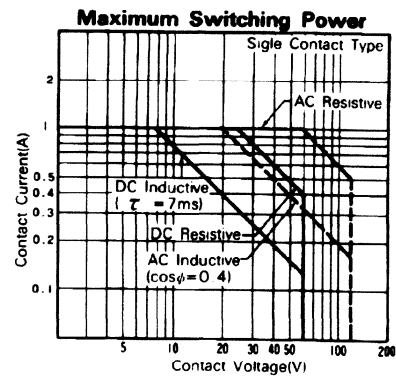
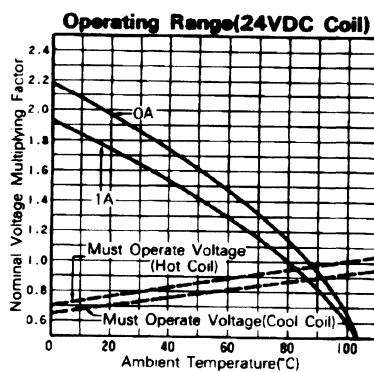
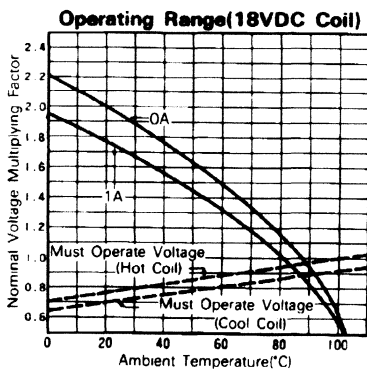
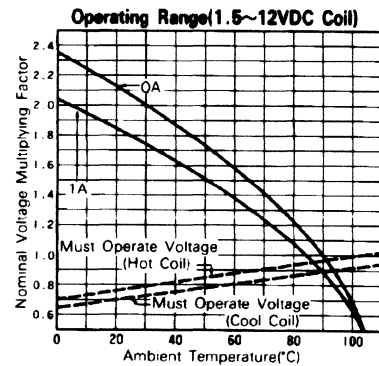
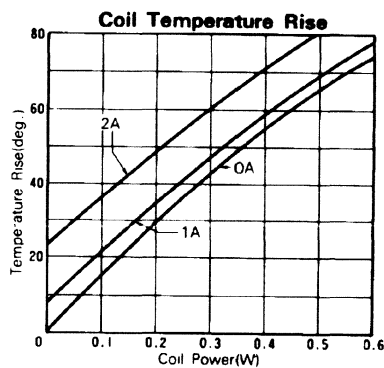
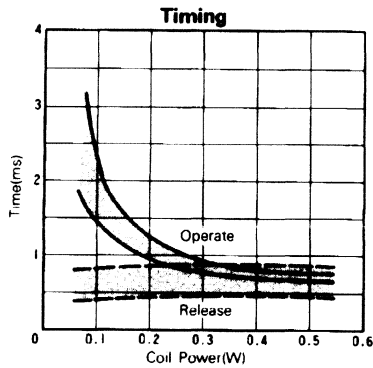
SY SERIES

COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance ($\pm 10\%$) | Must operate voltage | Must release voltage | Nominal power |
|----------|------------|-----------------|--------------------------------|----------------------|----------------------|---------------|
| Single | Bifurcated | | | | | |
| SY-1.5-K | SY-1.5W-K | 1.5 VDC | 15 Ω | 1.05 VDC | 0.08 VDC | 150 mW |
| SY- 3-K | SY- 3 W-K | 3 VDC | 60 Ω | 2.1 VDC | 0.15 VDC | 150 mW |
| SY-4.5-K | SY-4.5W-K | 4.5 VDC | 135 Ω | 3.2 VDC | 0.23 VDC | 150 mW |
| SY- 5-K | SY- 5 W-K | 5 VDC | 167 Ω | 3.5 VDC | 0.25 VDC | 150 mW |
| SY- 6-K | SY- 6 W-K | 6 VDC | 240 Ω | 4.2 VDC | 0.3 VDC | 150 mW |
| SY- 9-K | SY- 9 W-K | 9 VDC | 540 Ω | 6.3 VDC | 0.45 VDC | 150 mW |
| SY-12-K | SY-12 W-K | 12 VDC | 960 Ω | 8.4 VDC | 0.6 VDC | 150 mW |
| SY-18-K | SY-18 W-K | 18 VDC | 1,940 Ω | 12.6 VDC | 0.9 VDC | 170 mW |
| SY-24-K | SY-24 W-K | 24 VDC | 3,290 Ω | 16.8 VDC | 1.2 VDC | 175 mW |

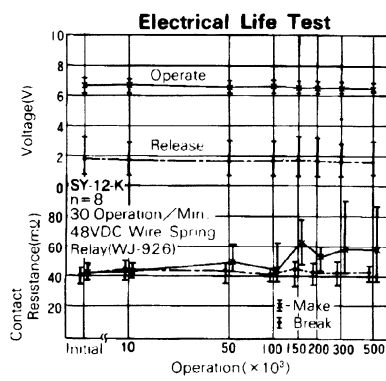
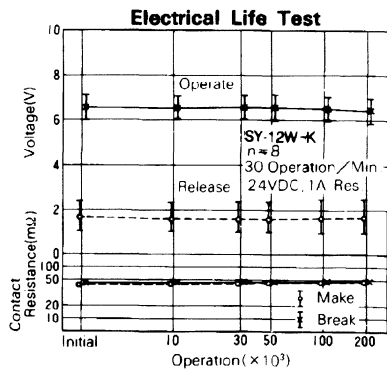
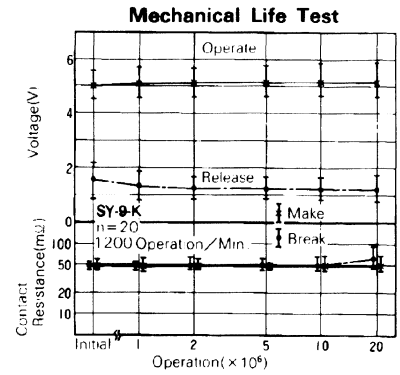
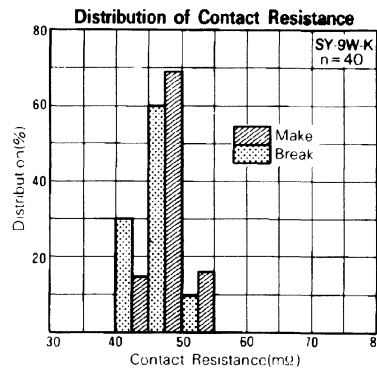
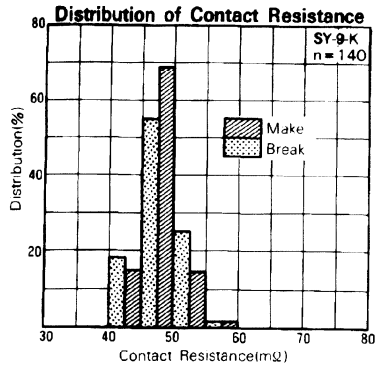
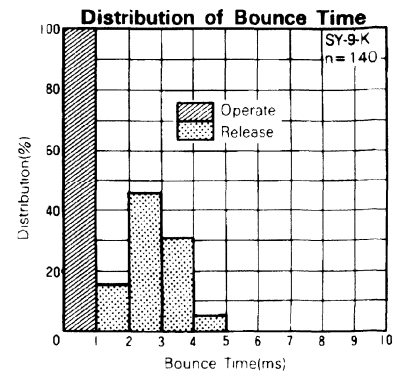
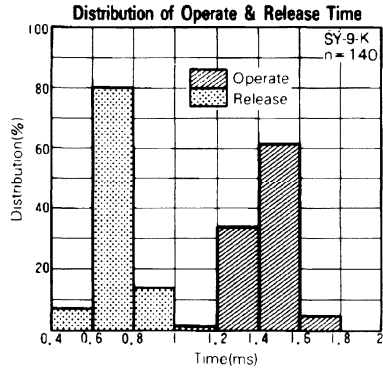
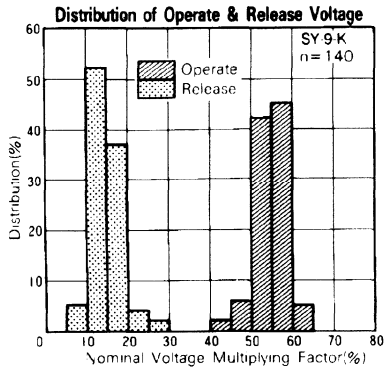
Note : All values in the table are measured at 20°C.

CHARACTERISTIC DATA



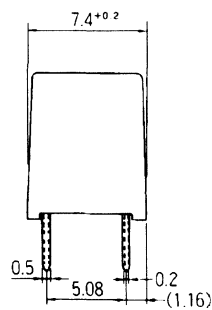
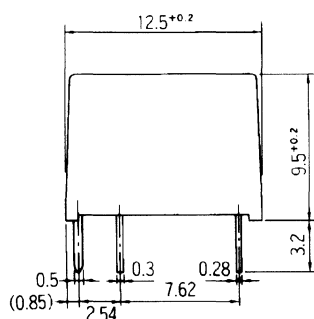
SY SERIES

REFERENCE DATA

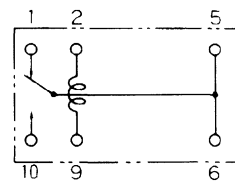


DIMENSIONS

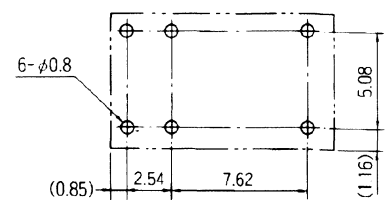
Dimensions



Schematics (Bottom View)



PC board mounting hole layout (Bottom View)



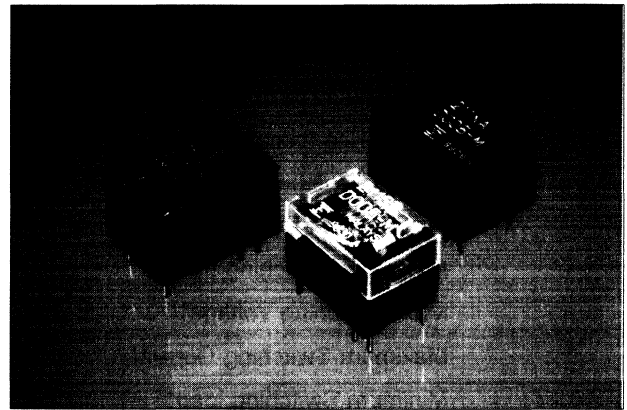
Unit: mm

MINIATURE RELAY

1 POLE—1 to 2 A (FOR SIGNAL SWITCHING) FBR211 SERIES

■ FEATURES

- 2 A maximum carrying current
Capable of 2 A maximum continuous carrying current in the contact
- Superior reliability gold-overlay contacts
P type: Gold-overlay silver-palladium contacts
- International terminal pitch of one inch grid terminal layout
- High sensitivity, low power dissipation types also available
Standard types: 0.45 W (A or B type)
High sensitivity types: 0.2 W (C or E type)
- Conforms to FCC 68.302 (high dielectric strength type)
- UL recognized (File number E63615)
- CSA recognized (File number LR64026)



■ ORDERING INFORMATION

[Example] FBR211 S A D012 U - P 2 (-CSA)
(a) (b) (c) (d) (e) (f) (g) (h)

| | | |
|-----|---------------------------|--|
| (a) | Series Name | FBR211 |
| (b) | Enclosure | S: Flux free type N: Plastic sealed type |
| (c) | Coil Power and Schematics | A: Standard A type } (nominal power 0.4 W type) B: Standard B type } C: High sensitivity C type } (nominal power 0.2 W type) E: High sensitivity E type } |
| (d) | Nominal Voltage | (Example) D003: 3 VDC D012: 12 VDC (refer to the COIL DATA CHART) |
| (e) | UL Standard | Nil : Standard U : UL114 recognized |
| (f) | Contact Material | P : Gold-overlay silver-palladium M : Gold-overlay silver |
| (g) | Special Type | Nil : Standard 2 : High dielectric strength type |
| (h) | CSA Standard | Nil : Standard -CSA : UL114 + CSA recognized (e) is U |

Note: The designation name is stamped on the top of the relay case as follows:
(Example) Designation ordered: FBR211SAD005-P
Stamp: 211SAD005-P

FBR211 SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL114 (File No. E63615)

C22.2 No. 0, No. 1, No. 14 (File No. LR40304 or LR64026)

| Nominal voltage | Contact rating |
|-----------------|--|
| 1.5 to 24 VDC | 1 A 28 VDC resistive 0.5 A 30 VAC resistive |

■ SPECIFICATIONS

| Item | | Standard (A or B type) | High sensitive (C or E type) | |
|--|--|--|---|---|
| Contact | Arrangement | 1 form C (SPDT) | | |
| | Material | Gold-overlay silver-palladium or gold-overlay silver | | |
| | Resistance (initial) | Maximum 100 mΩ (at 0.1 A 6 VDC) | | |
| | Rating (resistive) | 0.5 A 120 VAC or 1 A 28 VDC | | |
| | Maximum Carrying Current | 2 A | | |
| | Maximum Switching Power | 60 VA or 28 W | | |
| | Max. Switching Voltage* ¹ | 220 VAC or 150 VDC | | |
| | Maximum Switching Current | 1.25 A (AC) or 2 A (DC) | | |
| | Minimum Switching load* ² (reference) | Plastic sealed 1 mA 1 VDC Flux free 1 mA 5 VDC | | |
| Coil | Nominal Power (at 20°C) | Approximately 0.45 W | Approximately 0.2 W | |
| | Operate Power (at 20°C) | Approximately 0.315 W maximum | Approximately 0.14 W maximum | |
| | Operating Temperature | -25°C to +55°C (no frost) | -25°C to +75°C (no frost) | |
| | Operating Humidity | 45 to 85%RH | | |
| Time Value | Operate (at nominal voltage) | Maximum 5 ms | | |
| | Release (at nominal voltage) | Maximum 5 ms | | |
| Insulation | Resistance (initial) | Minimum 100 MΩ (at 500 VDC) | | |
| | Dielectric Strength | between coil and contacts | 500 VAC 1 minute (standard) 1,000 VAC 1 minute (high dielectric strength type) | |
| | | between open contacts | 500 VAC 1 minute | |
| Surge Strength (high dielectric strength type) | 1,500 V (10 x 700 μs) | | | |
| Life | Mechanical | 5 x 10 ⁶ operations minimum | | |
| | Electrical (Refer to the REFERENCE DATA) | 300 x 10 ³ operations minimum (at 1 A/ 28 VDC resistive load) | | |
| | | 100 x 10 ³ operations minimum (at 2 A/ 12 VDC resistive load) 100 x 10 ³ operations minimum (at 0.5 A/120 VDC resistive load) | | |
| Other | Vibration Resistance | 10 to 55 Hz (double amplitude of 1.5 mm) | | |
| | Shock Resistance | Misoperation | 100 m/s ² (11± ¹ ms) | 60 m/s ² (11± ¹ ms) |
| | | Endurance | 1,000 m/s ² (11± ¹ ms) | |
| | Weight | Approximately 4 g | | |

*¹ If the switching voltage exceeds the rated contact voltage, reduce the current. The current values vary according to the type of load.

*² Values when switching a resistive load at normal room temperature and humidity and in a clean environment. The minimum switching load varies with the switching frequency and operation environment.

FBR211 SERIES

COIL DATA CHART

1. STANDARD (A or B type)

| MODEL | | | | Nominal voltage | Coil resistance (±10%) | Nominal current (at nominal voltage) approx. | Must operate voltage | Must release voltage | Maximum allowable voltage | Nominal power | Coil temperature rise |
|--------------|----------------|--------------|----------------|-----------------|------------------------|--|-----------------------------|-----------------------------|---------------------------|-------------------------------------|-------------------------------------|
| A type | | B type | | | | | | | | | |
| Flux free | Plastic sealed | Flux free | Plastic sealed | | | | | | | | |
| FBR211SAD001 | FBR211NAD001 | FBR211SBD001 | FBR211NBD001 | 1.5 VDC | 5 Ω | 300 mA | 70% max. of nominal voltage | 10% min. of nominal voltage | 150% of nominal voltage | Approx. 450 mW (at nominal voltage) | Approx. 45 deg (at nominal voltage) |
| FBR211SAD003 | FBR211NAD003 | FBR211SBD003 | FBR211NBD003 | 3 VDC | 20 Ω | 150 mA | | | | | |
| FBR211SAD005 | FBR211NAD005 | FBR211SBD005 | FBR211NBD005 | 5 VDC | 56 Ω | 89 mA | | | | | |
| FBR211SAD006 | FBR211NAD006 | FBR211SBD006 | FBR211NBD006 | 6 VDC | 80 Ω | 75 mA | | | | | |
| FBR211SAD009 | FBR211NAD009 | FBR211SBD009 | FBR211NBD009 | 9 VDC | 180 Ω | 50 mA | | | | | |
| FBR211SAD012 | FBR211NAD012 | FBR211SBD012 | FBR211NBD012 | 12 VDC | 320 Ω | 38 mA | | | | | |
| FBR211SAD024 | FBR211NAD024 | FBR211SBD024 | FBR211NBD024 | 24 VDC | 1,280 Ω | 19 mA | | | | | |

Note: All values in the table are measured at 20°C.

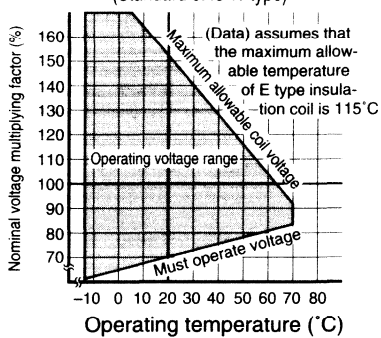
2. HIGH SENSITIVITY (C or E type)

| MODEL | | | | Nominal voltage | Coil resistance (±10%) | Nominal current (at nominal voltage) approx. | Must operate voltage | Must release voltage | Maximum allowable voltage | Nominal power | Coil temperature rise |
|--------------|----------------|--------------|----------------|-----------------|------------------------|--|-----------------------------|-----------------------------|---------------------------|-------------------------------------|-------------------------------------|
| C type | | E type | | | | | | | | | |
| Flux free | Plastic sealed | Flux free | Plastic sealed | | | | | | | | |
| FBR211SCD001 | FBR211NCD001 | FBR211SED001 | FBR211NED001 | 1.5 VDC | 12 Ω | 125 mA | 70% max. of nominal voltage | 10% min. of nominal voltage | 225% of nominal voltage | Approx. 200 mW (at nominal voltage) | Approx. 25 deg (at nominal voltage) |
| FBR211SCD003 | FBR211NCD003 | FBR211SED003 | FBR211NED003 | 3 VDC | 45 Ω | 67 mA | | | | | |
| FBR211SCD005 | FBR211NCD005 | FBR211SED005 | FBR211NED005 | 5 VDC | 120 Ω | 42 mA | | | | | |
| FBR211SCD006 | FBR211NCD006 | FBR211SED006 | FBR211NED006 | 6 VDC | 180 Ω | 33 mA | | | | | |
| FBR211SCD009 | FBR211NCD009 | FBR211SED009 | FBR211NED009 | 9 VDC | 400 Ω | 23 mA | | | | | |
| FBR211SCD012 | FBR211NCD012 | FBR211SED012 | FBR211NED012 | 12 VDC | 700 Ω | 17 mA | | | | | |
| FBR211SCD024 | FBR211NCD024 | FBR211SED024 | FBR211NED024 | 24 VDC | 2,800 Ω | 9 mA | | | | | |

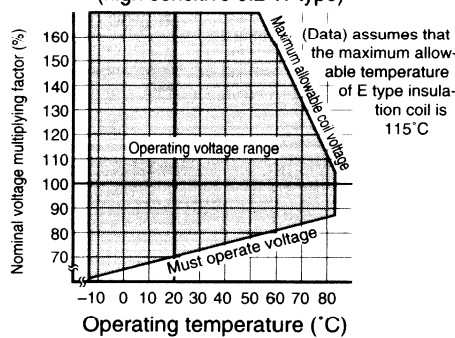
Note: All values in the table are measured at 20°C.

CHARACTERISTIC DATA

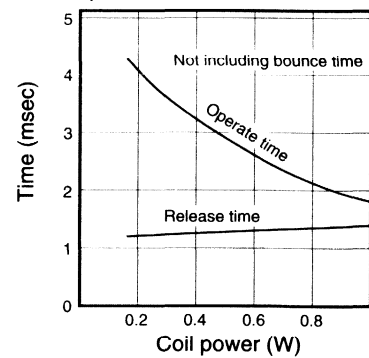
Range of operation temperature and voltage
(Standard 0.45 W type)



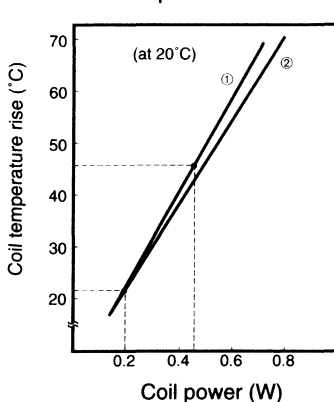
Range of operation temperature and voltage
(high sensitive 0.2 W type)



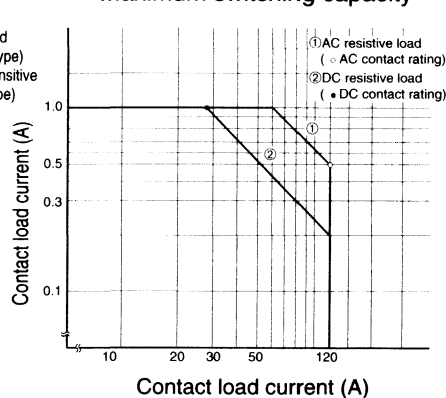
Operate and release time data



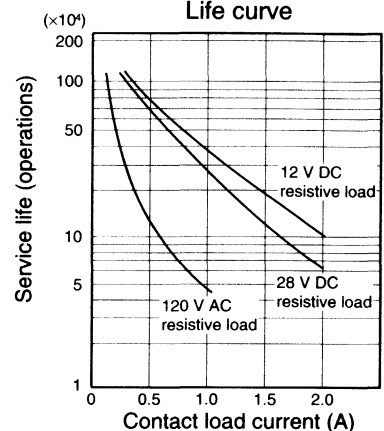
Coil temperature rise data



Maximum switching capacity



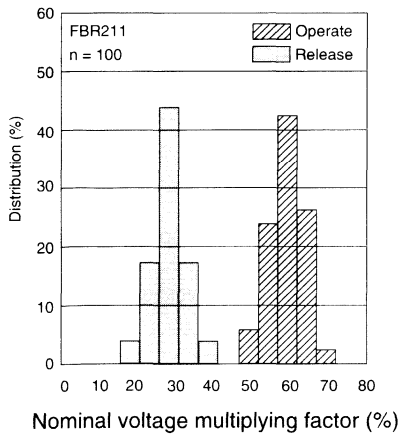
Life curve



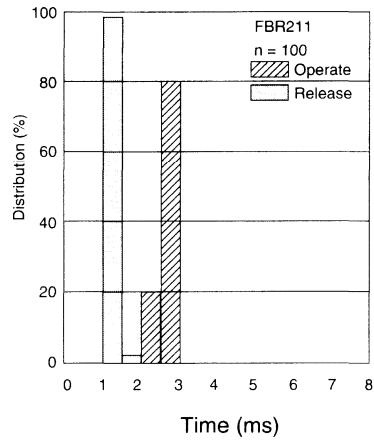
FBR211 SERIES

REFERENCE DATA

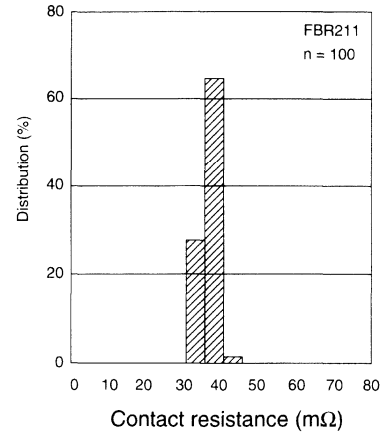
Distribution of operate and release voltage



Distribution of operate and release time



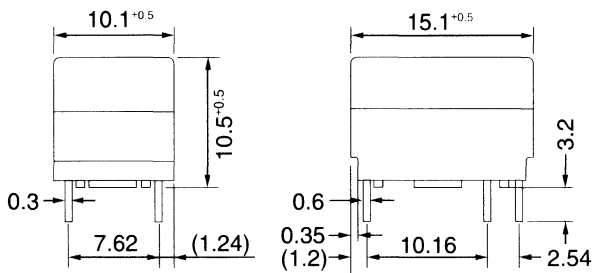
Distribution of contact resistance



DIMENSIONS

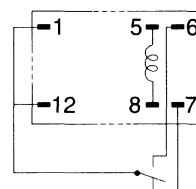
1. STANDARD (Flux free type)

●Dimensions

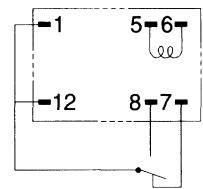


●Schematics (BOTTOM VIEW)

(A type or C type)

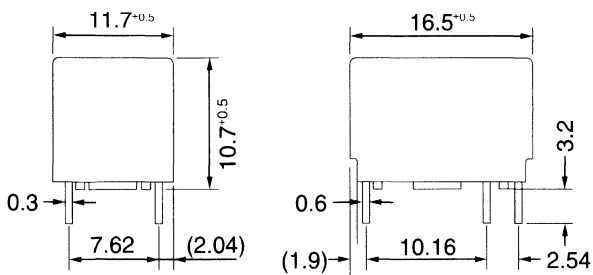


(B type or E type)



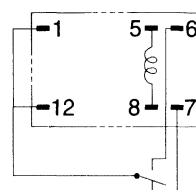
2. N-TYPE (Plastic sealed type)

●Dimensions

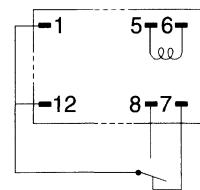


●Schematics (BOTTOM VIEW)

(A type or C type)

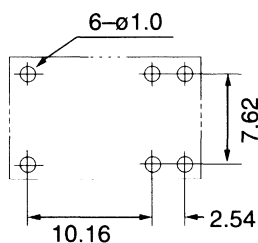


(B type or E type)



3. PC BOARD MOUNTING HOLE LAYOUT

●PC board mounting hole layout (BOTTOM VIEW)



Unit: mm

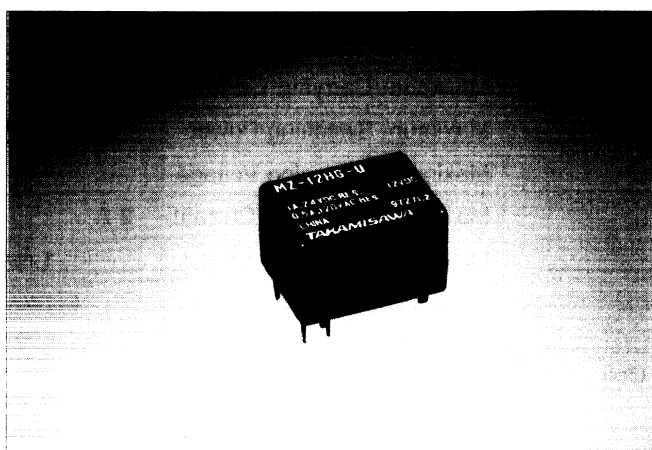
MINIATURE RELAY

1 POLE—1 to 2 A (FOR SIGNAL SWITCHING)

MZ SERIES

■ FEATURES

- Subminiature size
- Standard and high sensitivity types available
- UL, CSA recognized
- FCC rules and regulations part 68
—Dielectric strength 1,500 V between coil and contacts
- High reliability-bifurcated contacts available
- DIL pitch terminals
- Plastic sealed type backfilled with nitrogen available



■ ORDERING INFORMATION

[Example] MZ F - 12 W HG - K - U
 (a) (b) (c) (d) (e) (f) (g)

| | | |
|-----|---------------------|--|
| (a) | Series Name | MZ : MZ Series |
| (b) | Dielectric Function | Nil : Standard type F : High dielectric strength type |
| (c) | Nominal Voltage | Refer to the COIL DATA CHART |
| (d) | Contact | Nil : 1 A single D : 2 A single (without MZF) W : 1 A bifurcated type |
| (e) | Coil Type | HG : Standard type (without MZ-D) HS : High sensitivity type (without MZF/MZ-D) |
| (f) | Enclosure | Nil : Flux free type K : Plastic sealed type |
| (g) | UL, CSA Standard | Nil : Non UL, • CSA approved type U : UL • CSA approved type |

Note: For movable and stationary contact with gold overlay type, add suffix “-OH”.

■ SAFETY STANDARD AND FILE NUMBERS

UL478 (File No. E45026)

C22.2 No. 14 (File No. LR35579)

Please request when the approval markings are required on the cover.

| Nominal voltage | Contact rating |
|-----------------|-------------------------------------|
| 1.5 to 48 VDC | 0.5 A 120 VAC, 1 A 24 VDC resistive |
| | 1 A 120 VDC, 2 A 24 VDC resistive |

MZ SERIES

■ SPECIFICATIONS

| Item | | Standard | | | High Sensitivity Type | |
|----------------|------------------------------|---|---|------------|-----------------------|------------|
| | | Single | | Bifurcated | Single | Bifurcated |
| | | MZ-() D | MZ-() HG | MZ-() WHG | MZ-() HS | MZ-() WHS |
| Contact | Arrangement | 1 form C (SPDT) | | | | |
| | Material | Gold-overlay silver-alloy | Gold overlay silver-palladium | | | |
| | Resistance (initial) | Maximum 100 mΩ (at 1 A 6 VDC) | | | | |
| | Rating (resistive) | 2 A 24 VDC 1 A 120 VAC | 1 A 24 VDC 0.5 A 120 VAC | | | |
| | Maximum Carrying Current | 2 A | | | | |
| | Maximum Switching Power | 120 VA/48 W | 60 VA/24 W | | | |
| | Maximum Switching Voltage | 120 VAC, 60 VDC | | | | |
| | Maximum Switching Current | 2 A | 1 A | | | |
| | Minimum Switching Load* | 1 mA 1 VDC | 0.1 mA 100 mVDC | 1 mA 1 VDC | 0.1 mA 100 mVDC | |
| | Capacitance (at 10 MHz) | Approximately 0.8 pF (between open contacts, adjacent contacts) Approximately 7.5 pF (between coil and contacts) | | | | |
| Coil | Nominal Power (at 20°C) | 0.45 to 0.50 W | | | 0.19 to 0.27 W | |
| | Operate Power (at 20°C) | 0.22 to 0.25 W | | | 0.10 to 0.13 W | |
| | Operating Temperature | -30°C to +55°C (no frost) (refer to the CHARACTERISTIC DATA) | | | | |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | | | | |
| | Release (at nominal voltage) | Maximum 3 ms | | | | |
| Insulation | Resistance (at 500 VDC) | Minimum 100 MΩ | | | | |
| | Dielectric Strength | between open contacts | AC 500 V 1 minute (standard type) AC 1,000 V 1 minute (high dielectric strength type, MZF) | | | |
| | | between coil and contacts | AC 500 V 1 minute (standard type) AC 1,500 V 1 minute (high dielectric strength type, MZF) | | | |
| Surge Strength | 1,500 V | | | | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | | | |
| | Electrical (at rating) | 1 A 120 VAC 100 x 10 ³ ops. min. 2 A 24 VDC 200 x 10 ³ ops.min. | 0.5 A 120 VAC 200 x 10 ³ operations minimum 1 A 24 VAC 500 x 10 ³ operations minimum | | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 3.28 mm) | | | |
| | | Endurance | 10 to 55 Hz (double amplitude of 3.28 mm) | | | |
| | Shock Resistance | Misoperation | 100 m/s ² (11±1 ms) | | | |
| | | Endurance | 1,000 m/s ² (6±1 ms) | | | |
| | Weight | Approximately 3.5 g | | | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

MZ SERIES

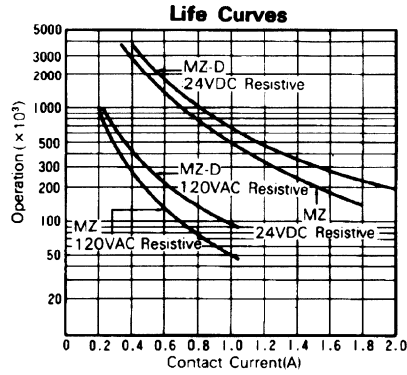
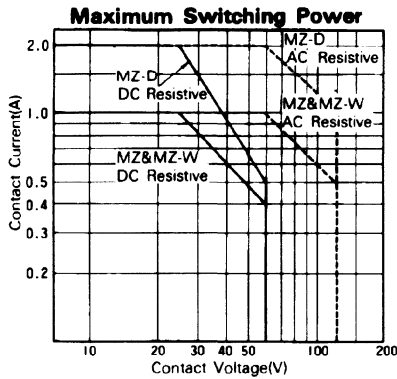
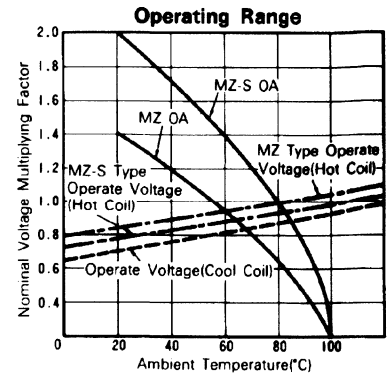
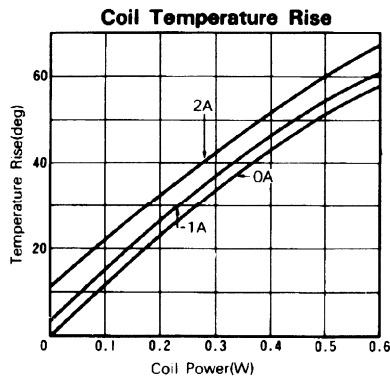
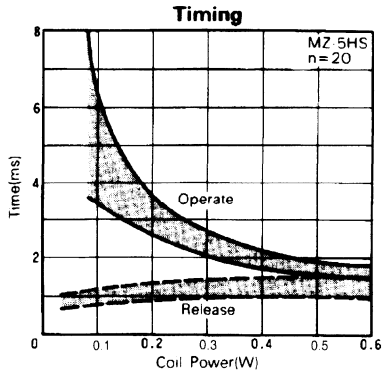
■ COIL DATA CHART

| | MODEL | | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage | Nominal power |
|-----------------------|------------------|------------------|---------------|-----------------|------------------------|----------------------|----------------------|---------------|
| | Single | | Bifurcated | | | | | |
| | 2 A Type | 1 A Type | 1 A Type | | | | | |
| Standard Type | MZ-1.5D-(K) | MZ (F)-1.5HG-(K) | MZ-1.5WHG-(K) | 1.5 VDC | 5 Ω | 1.05 VDC | 0.08 VDC | 450 mW |
| | MZ- 3 D-(K) | MZ (F)- 3 HG-(K) | MZ- 3 WHG-(K) | 3 VDC | 20 Ω | 2.1 VDC | 0.15 VDC | 450 mW |
| | MZ-4.5D-(K) | MZ (F)-4.5HG-(K) | MZ-4.5WHG-(K) | 4.5 VDC | 45 Ω | 3.15 VDC | 0.23 VDC | 450 mW |
| | MZ- 5 D-(K) | MZ (F)- 5 HG-(K) | MZ- 5 WHG-(K) | 5 VDC | 56 Ω | 3.5 VDC | 0.25 VDC | 450 mW |
| | MZ- 6 D-(K) | MZ (F)- 6 HG-(K) | MZ- 6 WHG-(K) | 6 VDC | 80 Ω | 4.2 VDC | 0.3 VDC | 450 mW |
| | MZ- 9 D-(K) | MZ (F)- 9 HG-(K) | MZ- 9 WHG-(K) | 9 VDC | 180 Ω | 6.3 VDC | 0.45 VDC | 450 mW |
| | MZ-12 D-(K) | MZ (F)-12 HG-(K) | MZ-12 WHG-(K) | 12 VDC | 320 Ω | 8.4 VDC | 0.6 VDC | 450 mW |
| | MZ-18 D-(K) | MZ (F)-18 HG-(K) | MZ-18 WHG-(K) | 18 VDC | 720 Ω | 12.6 VDC | 0.9 VDC | 450 mW |
| | MZ-24 D-(K) | MZ (F)-24 HG-(K) | MZ-24 WHG-(K) | 24 VDC | 1,280 Ω | 16.8 VDC | 1.2 VDC | 450 mW |
| MZ-48 D-(K) | MZ (F)-48 HG-(K) | MZ-48 WHG-(K) | 48 VDC | 4,600 Ω | 33.6 VDC | 2.4 VDC | 500 mW | |
| High Sensitivity Type | | MZ-1.5HS-(K) | MZ-1.5WHS-(K) | 1.5 VDC | 12 Ω | 1.05 VDC | 0.08 VDC | 190 mW |
| | | MZ- 3 HS-(K) | MZ- 3 WHS-(K) | 3 VDC | 45 Ω | 2.1 VDC | 0.15 VDC | 200 mW |
| | | MZ-4.5HS-(K) | MZ-4.5WHS-(K) | 4.5 VDC | 100 Ω | 3.15 VDC | 0.23 VDC | 200 mW |
| | | MZ- 5 HS-(K) | MZ- 5 WHS-(K) | 5 VDC | 120 Ω | 3.5 VDC | 0.25 VDC | 200 mW |
| | | MZ- 6 HS-(K) | MZ- 6 WHS-(K) | 6 VDC | 180 Ω | 4.2 VDC | 0.3 VDC | 200 mW |
| | | MZ- 9 HS-(K) | MZ- 9 WHS-(K) | 9 VDC | 400 Ω | 6.3 VDC | 0.45 VDC | 200 mW |
| | | MZ-12 HS-(K) | MZ-12 WHS-(K) | 12 VDC | 700 Ω | 8.4 VDC | 0.6 VDC | 200 mW |
| | | MZ-15 HS-(K) | MZ-15 WHS-(K) | 15 VDC | 1,100 Ω | 10.5 VDC | 0.75 VDC | 200 mW |
| | | MZ-18 HS-(K) | MZ-18 WHS-(K) | 18 VDC | 1,600 Ω | 12.6 VDC | 0.9 VDC | 200 mW |
| | | MZ-24 HS-(K) | MZ-24 WHS-(K) | 24 VDC | 2,800 Ω | 16.8 VDC | 1.2 VDC | 200 mW |
| | MZ-48 HS-(K) | MZ-48 WHS-(K) | 48 VDC | 8,500 Ω | 33.6 VDC | 2.4 VDC | 270 mW | |

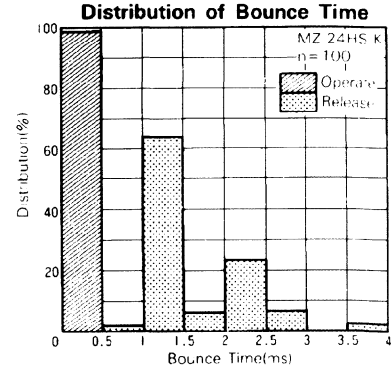
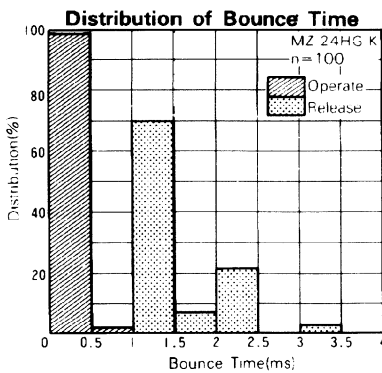
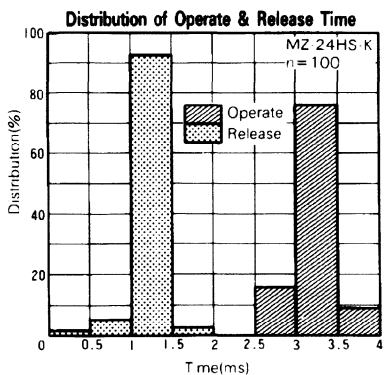
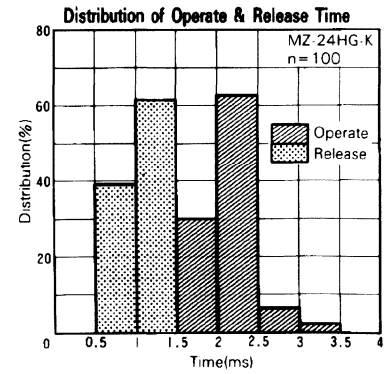
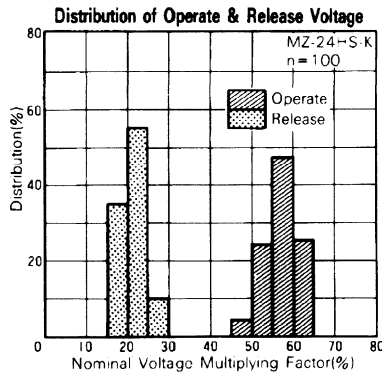
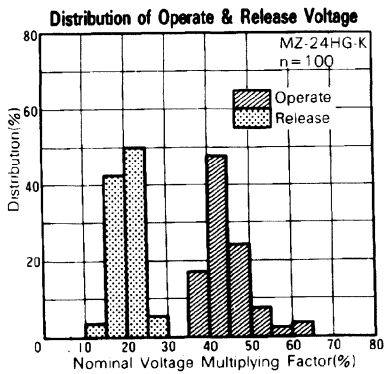
Note: All values in the table are measured at 20°C.

MZ SERIES

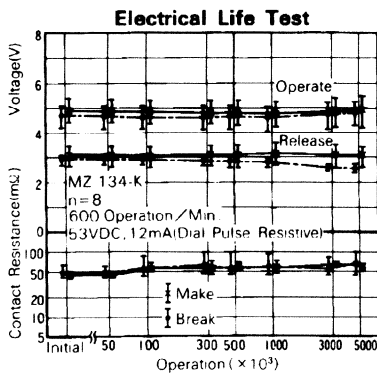
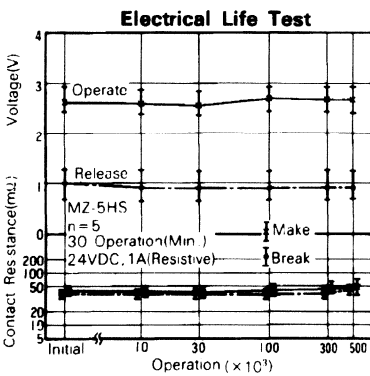
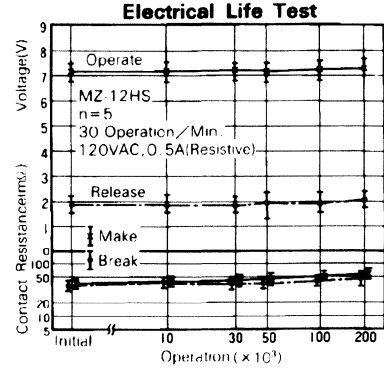
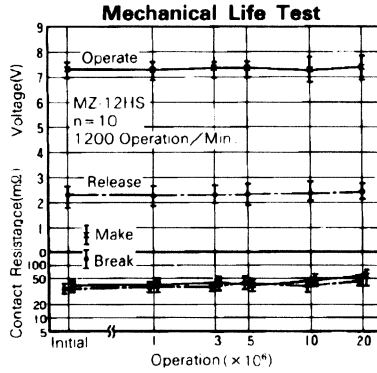
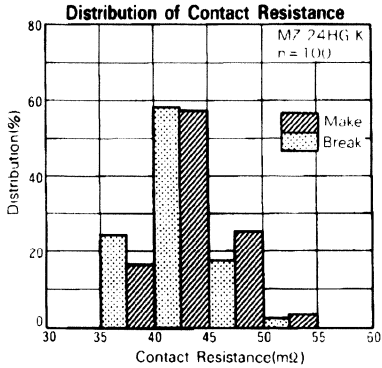
CHARACTERISTIC DATA



REFERENCE DATA



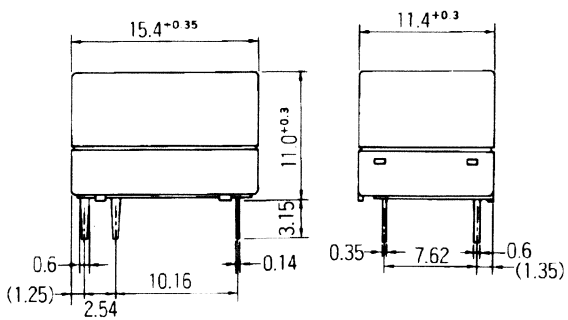
MZ SERIES



DIMENSIONS

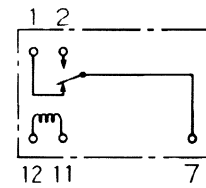
● Dimensions

MZ (F) type (Flux free type)



● Schematics

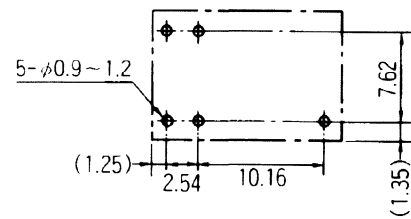
(Bottom View)



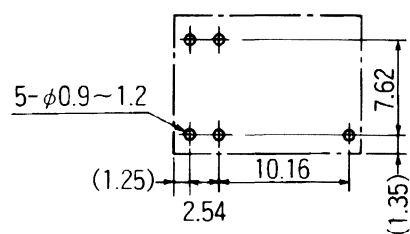
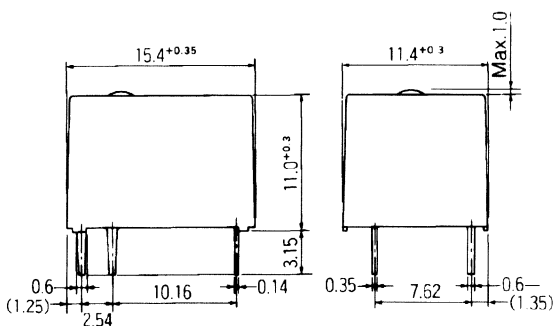
● PC board mounting

hole layout

(Bottom View)



MZ (F)-K type (Plastic sealed type)



Unit: mm

MZ SERIES

NOTES

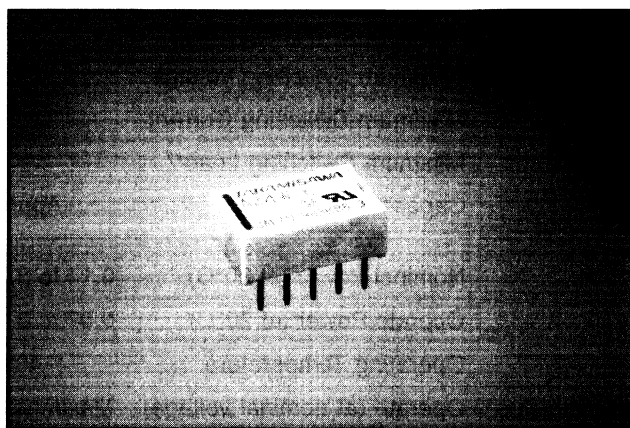


MINIATURE RELAY

2 POLES—1 to 2 A (FOR SIGNAL SWITCHING) A SERIES

■ FEATURES

- Extremely low profile and light weight
 - Height: 5 mm
 - Weight: approximately 1.2 g
- UL, CSA recognized
- Conforms to FCC rules and regulations part 68
 - Surge strength 1,500 V
- High reliability—bifurcated contacts
- Wide operating range
- DIL pitch terminals
- Plastic sealed type backfilled with nitrogen
- Latching version available



■ ORDERING INFORMATION

[Example] $\frac{A}{(a)} \frac{L}{(b)} - \frac{D}{(*)} \frac{12}{(c)} \frac{W}{(d)} - \frac{K}{(e)} \frac{12}{(f)}$

| | | |
|-----|--------------------|--|
| (a) | Series Name | A : A Series |
| (b) | Operation Function | Nil : Standard type L : Latching type |
| (c) | Number of Coil | Nil : Single winding type D : Double winding type |
| (d) | Nominal Voltage | Refer to the COIL DATA CHART |
| (e) | Contact | W : Bifurcated type |
| (f) | Enclosure | K : Plastic sealed type |

Note: Actual marking omits the hyphen (-) of (*)

■ SAFETY STANDARD AND FILE NUMBERS

UL478 (File No. E45026)

C22.2 No. 0. No. 14 (File No. LR35579)

| Nominal voltage | Contact rating | | | | | | | | |
|-----------------|---|-------|-----------|---|-----------|-----|--------|-------|---------|
| 1.5 to 48 VDC | <table style="display: inline-table; border: none;"> <tr> <td>0.5 A</td> <td>125 VAC</td> <td rowspan="3" style="font-size: 2em; vertical-align: middle;">}</td> <td rowspan="3" style="padding-left: 10px;">resistive</td> </tr> <tr> <td>2 A</td> <td>30 VDC</td> </tr> <tr> <td>0.3 A</td> <td>110 VDC</td> </tr> </table> | 0.5 A | 125 VAC | } | resistive | 2 A | 30 VDC | 0.3 A | 110 VDC |
| 0.5 A | 125 VAC | } | resistive | | | | | | |
| 2 A | 30 VDC | | | | | | | | |
| 0.3 A | 110 VDC | | | | | | | | |

Only UL/CSA approval markings are marked on the cover.

A SERIES

■ SPECIFICATIONS

| Item | | Standard Type | Single Winding Latching Type | Double Winding Latching Type |
|------------|------------------------------|---|--|------------------------------|
| | | A-() W-K | AL-() W-K | AL-D () W-K |
| Contact | Arrangement | 2 form C (DPDT) | | |
| | Material | Gold overlay silver alloy | | |
| | Resistance (initial) | Maximum 50 mΩ (at 1 A 6 VDC) | | |
| | Rating (resistive) | 0.5 A 125 VAC or 1 A 30 VDC | | |
| | Maximum Carrying Current | 2 A | | |
| | Maximum Switching Power | 62.5 VA/30 W | | |
| | Maximum Switching Voltage | 250 VAC, 220 VDC | | |
| | Maximum Switching Current | 2 A | | |
| | Minimum Switching Load*1 | 0.01 mA 10 mVDC | | |
| | Capacitance | Approximately 0.5 pF (between open contacts, adjacent contacts) Approximately 1.0 pF (between coil and contacts) | | |
| Coil | Nominal Power (at 20°C) | 0.14 to 0.3 W | 0.1 to 0.15 W | 0.20 to 0.3 W |
| | Operate Power (at 20°C) | 0.07 to 0.15 W | 0.05 to 0.075 W | 0.1 to 0.15 W |
| | Operating Temperature | -40°C to +85°C (no frost) (refer to the CHARACTERISTIC DATA) | | |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | Maximum 6 ms (set) | |
| | Release (at nominal voltage) | Maximum 4 ms | Maximum 6 ms (reset) | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute | |
| | | between adjacent contacts | 1,000 VAC 1 minute | |
| | | 5252between coil and contacts | 1,000 VAC 1 minute | |
| | Surge Strength | 1,500 V | | |
| Life | Mechanical | 100 x 10 ⁶ operations minimum | 10 x 10 ⁶ operations minimum | |
| | Electrical | 200 x 10 ³ ops. min. (0.5 A 125 VAC), 500 x 10 ³ ops. min. (1 A 30 VDC) | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 3.3 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 5.0 mm) | |
| | Shock Resistance | Misoperation | 500 m/s ² (11 ±1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| | Weight | Approximately 1.2 g | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

A SERIES

COIL DATA CHART

| | MODEL | Nominal voltage | Coil resistance ($\pm 10\%$) | Must operate voltage* ¹ | Must release voltage* ¹ | Nominal power |
|---------------|----------|-----------------|--------------------------------|------------------------------------|------------------------------------|---------------|
| Standard Type | A-1.5W-K | 1.5 VDC | 16.1 Ω | +1.05 VDC | +0.15 VDC | 140 mW |
| | A- 3 W-K | 3 VDC | 64.3 Ω | +2.1 VDC | +0.3 VDC | 140 mW |
| | A-4.5W-K | 4.5 VDC | 145 Ω | +3.15 VDC | +0.45 VDC | 140 mW |
| | A- 5 W-K | 5 VDC | 178 Ω | +3.5 VDC | +0.5 VDC | 140 mW |
| | A- 6 W-K | 6 VDC | 257 Ω | +4.2 VDC | +0.6 VDC | 140 mW |
| | A- 9 W-K | 9 VDC | 579 Ω | +6.3 VDC | +0.9 VDC | 140 mW |
| | A-12 W-K | 12 VDC | 1,028 Ω | +8.4 VDC | +1.2 VDC | 140 mW |
| | A-18 W-K | 18 VDC | 1,620 Ω | +12.6 VDC | +1.8 VDC | 200 mW |
| | A-24 W-K | 24 VDC | 2,880 Ω | +16.8 VDC | +2.4 VDC | 200 mW |
| | A-48 W-K | 48 VDC | 7,680 Ω | +33.6 VDC | +4.8 VDC | 300 mW |

Note: *¹ Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

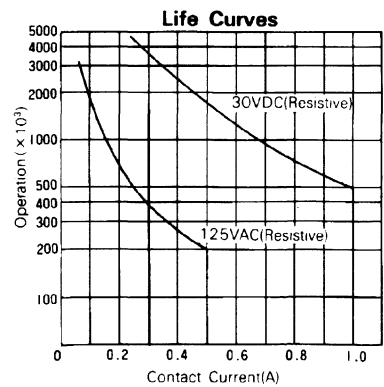
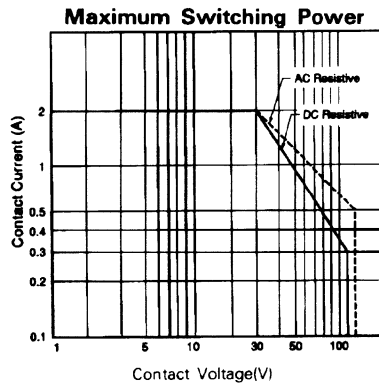
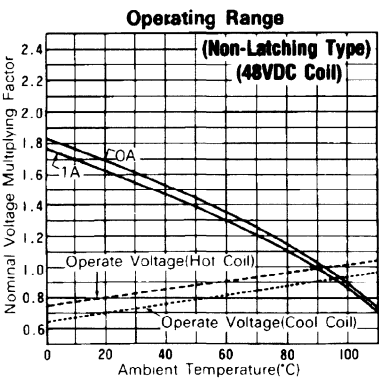
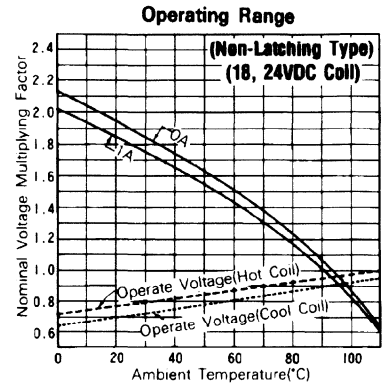
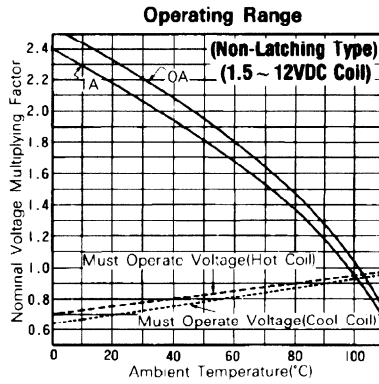
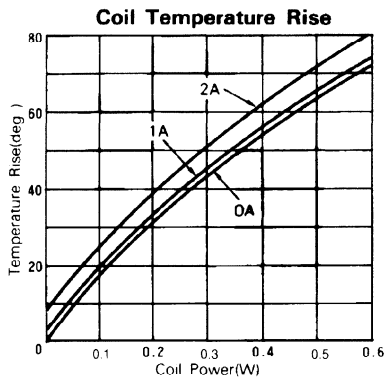
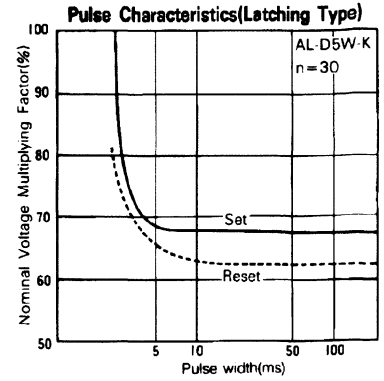
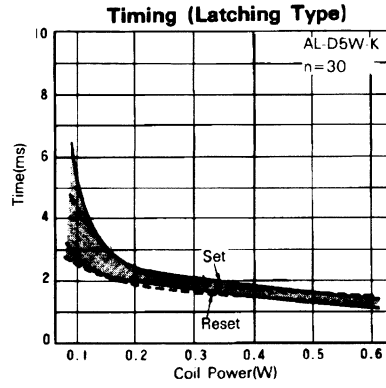
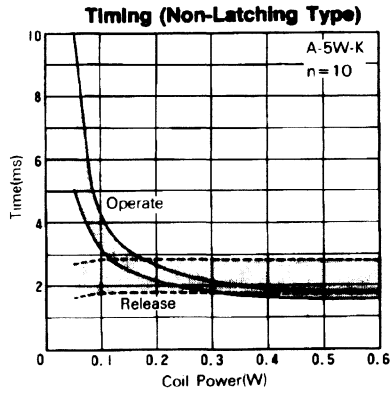
| | MODEL | Nominal voltage | Coil resistance ($\pm 10\%$) | Set voltage* ¹ | Reset voltage* ¹ | Nominal power |
|------------------------------|------------|------------------|--------------------------------|---------------------------|-----------------------------|---------------|
| Single Winding Latching Type | AL-1.5W-K | 1.5 VDC | 22.5 Ω | +1.05 VDC | -1.05 VDC | 100 mW |
| | AL- 3 W-K | 3 VDC | 90 Ω | +2.1 VDC | -2.1 VDC | 100 mW |
| | AL-4.5W-K | 4.5 VDC | 203 Ω | +3.15 VDC | -3.15 VDC | 100 mW |
| | AL- 5 W-K | 5 VDC | 250 Ω | +3.5 VDC | -3.5 VDC | 100 mW |
| | AL- 6 W-K | 6 VDC | 360 Ω | +4.2 VDC | -4.2 VDC | 100 mW |
| | AL- 9 W-K | 9 VDC | 810 Ω | +6.3 VDC | -6.3 VDC | 100 mW |
| | AL-12 W-K | 12 VDC | 1,440 Ω | +8.4 VDC | -8.4 VDC | 100 mW |
| | AL-18 W-K | 18 VDC | 2,160 Ω | +12.6 VDC | -12.6 VDC | 150 mW |
| | AL-24 W-K | 24 VDC | 3,840 Ω | +16.8 VDC | -16.8 VDC | 150 mW |
| Double Winding Latching Type | AL-D1.5W-K | 1.5 VDC | P 11.25 Ω | +1.05 VDC | | 200 mW |
| | | | S 11.25 Ω | | +1.05 VDC | |
| | AL-D 3 W-K | 3 VDC | P 45 Ω | +2.1 VDC | | 200 mW |
| | | | S 45 Ω | | +2.1 VDC | |
| | AL-D4.5W-K | 4.5 VDC | P 101 Ω | +3.15 VDC | | 200 mW |
| | | | S 101 Ω | | +3.15 VDC | |
| | AL-D 5 W-K | 5 VDC | P 125 Ω | +3.5 VDC | | 200 mW |
| | | | S 125 Ω | | +3.5 VDC | |
| | AL-D 6 W-K | 6 VDC | P 180 Ω | +4.2 VDC | | 200 mW |
| | | | S 180 Ω | | +4.2 VDC | |
| | AL-D 9 W-K | 9 VDC | P 405 Ω | +6.3 VDC | | 200 mW |
| | | | S 405 Ω | | +6.3 VDC | |
| AL-D12 W-K | 12 VDC | P 720 Ω | +8.4 VDC | | 200 mW | |
| | | S 720 Ω | | +8.4 VDC | | |
| AL-D18 W-K | 18 VDC | P 1,080 Ω | +12.6 VDC | | 300 mW | |
| | | S 1,080 Ω | | +12.6 VDC | | |
| AL-D24 W-K | 24 VDC | P 1,920 Ω | +16.8 VDC | | 300 mW | |
| | | S 1,920 Ω | | +16.8 VDC | | |

Note: *¹ Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

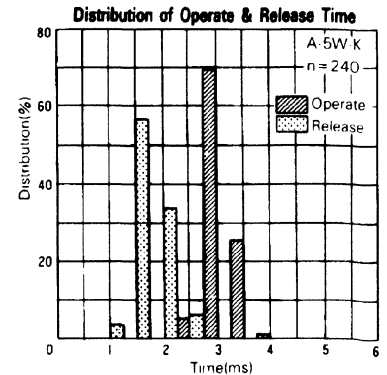
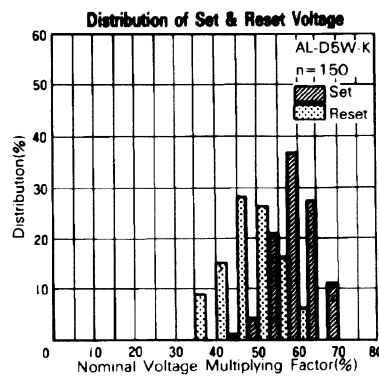
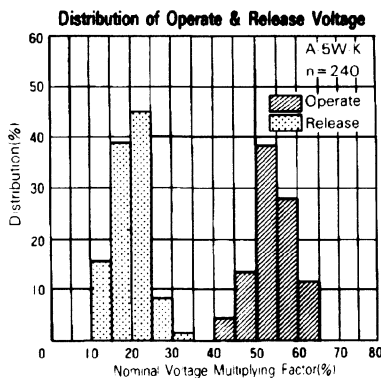
P: Primary coil S: Secondary coil

A SERIES

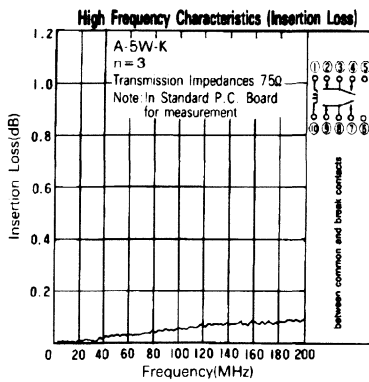
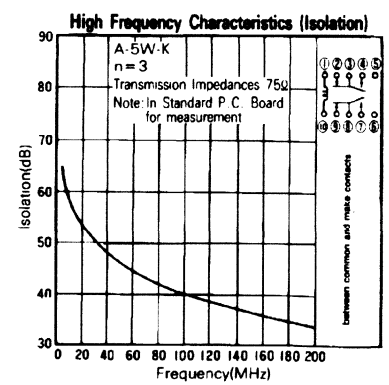
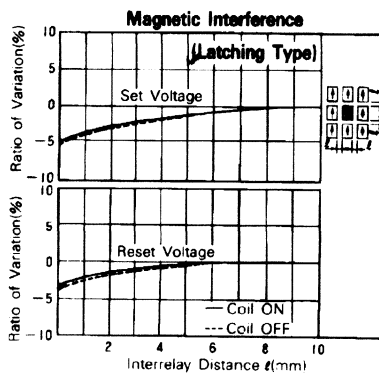
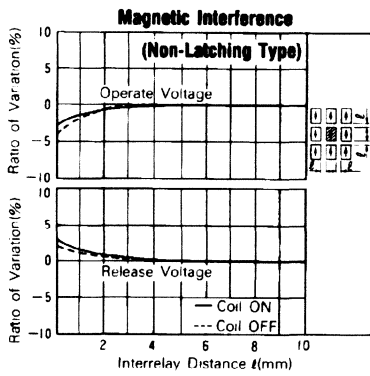
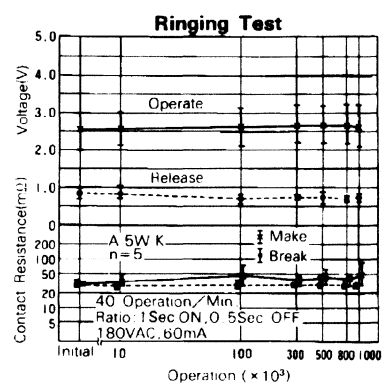
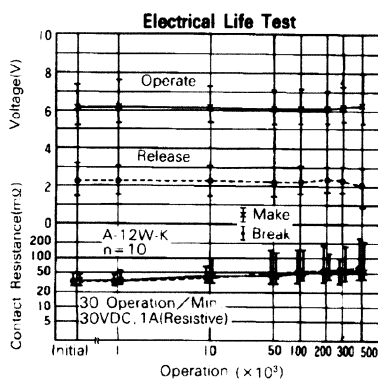
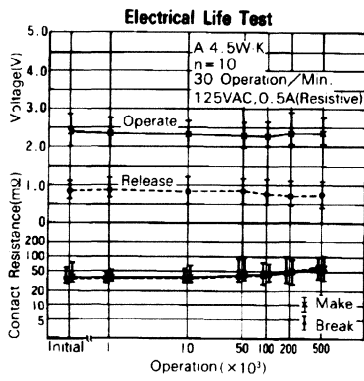
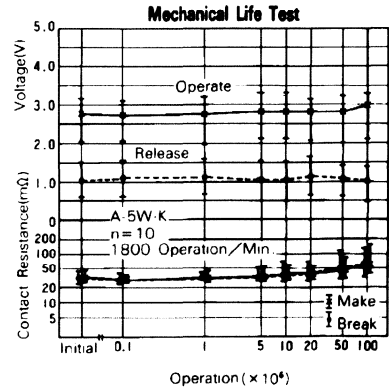
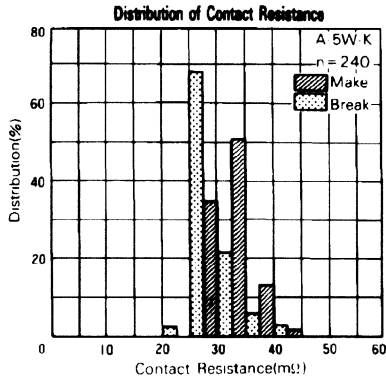
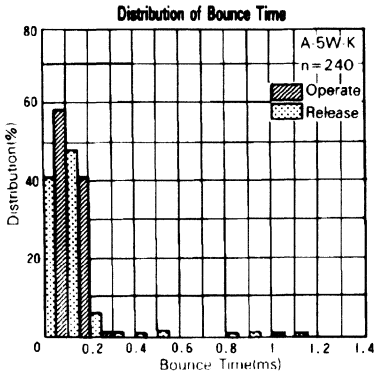
CHARACTERISTIC DATA



REFERENCE DATA



A SERIES



A SERIES

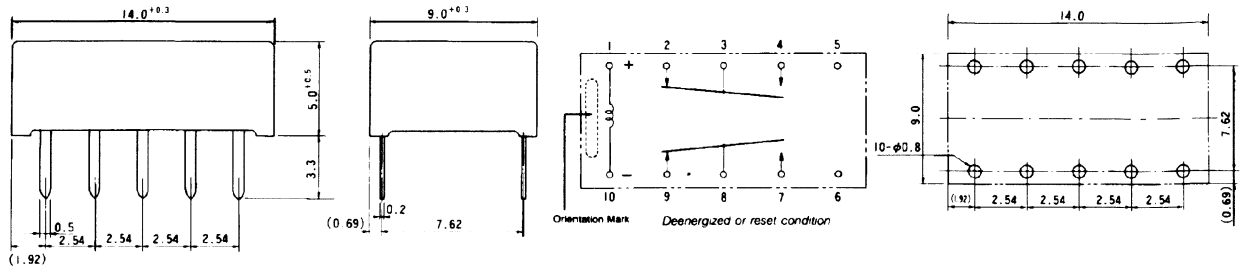
■ DIMENSIONS

● Dimensions

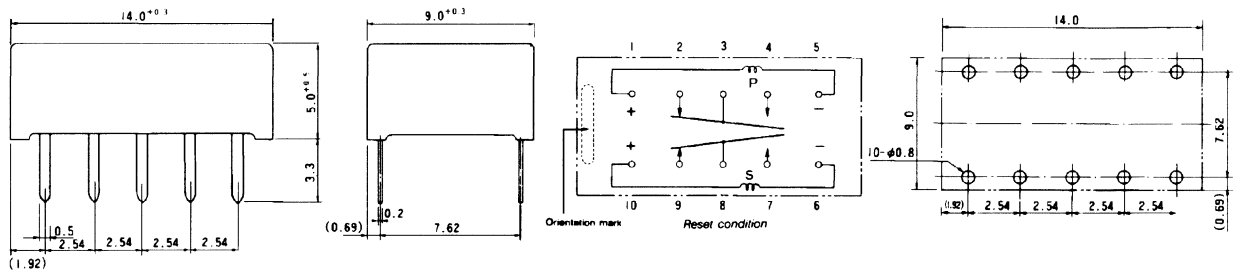
● Schematics (Bottom View)

● PC board mounting hole layout (Bottom View)

A, AL type (Non-latching type, single winding latching type)



AL-D type (Double winding latching type)



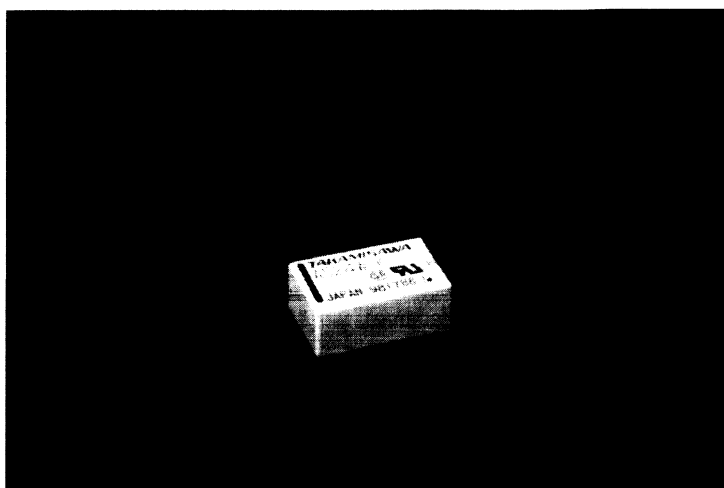
Unit: mm

MINIATURE RELAY

2 POLES—1 to 2 A (FOR SIGNAL SWITCHING) AS SERIES

■ FEATURES

- Flat type relay for surface mounting
- Super small and light weight
 - Height: 6.5 mm
 - Weight: approximately 1.5 g
- UL, CSA recognized
- Conforms to FCC Part 68
 - Surge strength 1,500 V
- High sensitivity and low power consumption
- High reliability—bifurcated contacts
- DIL pitch terminals
- Plastic sealed type backfilled with nitrogen



■ ORDERING INFORMATION

[Example] AS L - D 12 W - K - B 05
 (a) (b) (*) (c) (d) (e) (*) (f) (*) (g) (h)

| | | |
|-----|--------------------------|--|
| (a) | Series Name | AS : AS Series |
| (b) | Operation Function | Nil : Standard type L : Latching type |
| (c) | Number of Coil | Nil : Single winding type D : Double winding type |
| (d) | Nominal Voltage | Refer to the COIL DATA CHART |
| (e) | Contact | W : Bifurcated type |
| (f) | Enclosure | K : Plastic sealed type |
| (g) | Packing Orientation Cord | B : Standard type |
| (h) | Packing Orientation Cord | 05 : 500 pieces |

Note: Actual marking omits the hyphen (-) of (*) and "-B05"

AS SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL478 (File No. E45026)

C22.2 No. 0, No. 14 (File No. LR35579)

Only UL/CSA approval markings are marked on the cover.

| Nominal voltage | Contact rating | | |
|-----------------|----------------|---------|-----------|
| 1.5 to 48 VDC | 0.5 A | 125 VAC | resistive |
| | 2 A | 30 VDC | |
| | 0.3 A | 110 VDC | |

■ SPECIFICATIONS

| Item | | Standard Type | Single Winding Latching Type | Double Winding Latching Type |
|----------------|------------------------------|---|--|------------------------------|
| | | AS-() W-K | ASL-() W-K | ASL-D () W-K |
| Contact | Arrangement | 2 Form C (DPDT) | | |
| | Material | Gold overlay silver alloy | | |
| | Style | Bifurcated | | |
| | Resistance (initial) | Maximum 50 mΩ (at 1 A 6 VDC) | | |
| | Rating (resistive) | 0.5 A 125 VAC or 1 A 30 VDC | | |
| | Maximum Carrying Current | 2 A | | |
| | Maximum Switching Power | 62.5 VA, 30 W | | |
| | Maximum Switching Voltage | 250 VAC, 220 VDC | | |
| | Maximum Switching Current | 2 A | | |
| | Minimum Switching Load*1 | 0.01 mA 10 mVDC | | |
| | Capacitance (at 1 kHz) | Approximately 0.5 pF (between open contacts, adjacent contacts) Approximately 1.0 pF (between coil and contacts) | | |
| Coil | Nominal Power (at 20°C) | 0.14 to 0.3 W | 0.1 to 0.15 W | 0.20 to 0.3 W |
| | Operate Power (at 20°C) | 0.08 to 0.17 W | 0.057 to 0.085 W | 0.113 to 0.17 W |
| | Operating Temperature | -40°C to +85°C (no frost) (refer to the CHARACTERISTIC DATA) | | |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | Maximum 6 ms (set) | |
| | Release (at nominal voltage) | Maximum 4 ms | Maximum 6 ms (reset) | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | |
| | Dielectric Strength | between open contacts | 750 VAC 1 minute | |
| | | between adjacent contacts | 1,000 VAC 1 minute | |
| | | between coil and contacts | 1,000 VAC 1 minute | |
| Surge Strength | 1,500 V (at 10 x 160 μs) | | | |
| Life | Mechanical | 100 x 10 ⁶ operations minimum | 10 x 10 ⁶ operations minimum | |
| | Electrical | 200 x 10 ³ ops. min. (0.5 A 125 VAC), 5 x 10 ³ ops. min. (1 A 30 VDC) | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 3.3 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 5.0 mm) | |
| | Shock Resistance | Misoperation | 500 m/s ² (11 ±1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| | Weight | Approximately 1.5 g | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

AS SERIES

■ COIL DATA CHART

| | MODEL | Nominal voltage | Coil resistance (±10%) | Must operate voltage*1 | Must release voltage*1 | Nominal power |
|---------------|------------|-----------------|------------------------|------------------------|------------------------|---------------|
| Standard Type | AS-1.5 W-K | 1.5 VDC | 16.1 Ω | +1.13 VDC | +0.15 VDC | 140 mW |
| | AS- 3 W-K | 3 VDC | 64.3 Ω | +2.25 VDC | +0.3 VDC | 140 mW |
| | AS-4.5 W-K | 4.5 VDC | 145 Ω | +3.38 VDC | +0.45 VDC | 140 mW |
| | AS- 5 W-K | 5 VDC | 178 Ω | +3.75 VDC | +0.5 VDC | 140 mW |
| | AS- 6 W-K | 6 VDC | 257 Ω | +4.5 VDC | +0.6 VDC | 140 mW |
| | AS- 9 W-K | 9 VDC | 579 Ω | +6.75 VDC | +0.9 VDC | 140 mW |
| | AS- 12 W-K | 12 VDC | 1,028 Ω | +9.0 VDC | +1.2 VDC | 140 mW |
| | AS- 18 W-K | 18 VDC | 1,620 Ω | +13.5 VDC | +1.8 VDC | 200 mW |
| | AS- 24 W-K | 24 VDC | 2,880 Ω | +18.0 VDC | +2.4 VDC | 200 mW |
| | AS- 48 W-K | 48 VDC | 7,680 Ω | +36.0 VDC | +4.8 VDC | 300 mW |

Note: *1 Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

| | MODEL | Nominal voltage | Coil resistance (±10%) | Set voltage*1 | Reset voltage*1 | Nominal power |
|------------------------------|--------------|-----------------|------------------------|---------------|-----------------|---------------|
| Single Winding Latching Type | ASL-1.5 W-K | 1.5 VDC | 22.5 Ω | +1.13 VDC | -1.13 VDC | 100 mW |
| | ASL- 3 W-K | 3 VDC | 90 Ω | +2.25 VDC | -2.25 VDC | 100 mW |
| | ASL-4.5 W-K | 4.5 VDC | 203 Ω | +3.38 VDC | -3.38 VDC | 100 mW |
| | ASL- 5 W-K | 5 VDC | 250 Ω | +3.75 VDC | -3.75 VDC | 100 mW |
| | ASL- 6 W-K | 6 VDC | 360 Ω | +4.5 VDC | -4.5 VDC | 100 mW |
| | ASL- 9 W-K | 9 VDC | 810 Ω | +6.75 VDC | -6.75 VDC | 100 mW |
| | ASL- 12 W-K | 12 VDC | 1,440 Ω | +9.0 VDC | -9.0 VDC | 100 mW |
| | ASL- 18 W-K | 18 VDC | 2,160 Ω | +13.5 VDC | -13.5 VDC | 150 mW |
| | ASL- 24 W-K | 24 VDC | 3,840 Ω | +18.0 VDC | -18.0 VDC | 150 mW |
| Double Winding Latching Type | ASL-D1.5 W-K | 1.5 VDC | P 11.25 Ω | +1.13 VDC | | 200 mW |
| | | | S 11.25 Ω | | | |
| | ASL-D 3 W-K | 3 VDC | P 45 Ω | +2.25 VDC | | 200 mW |
| | | | S 45 Ω | | | |
| | ASL-D4.5 W-K | 4.5 VDC | P 101 Ω | +3.38 VDC | | 200 mW |
| | | | S 101 Ω | | | |
| | ASL-D 5 W-K | 5 VDC | P 125 Ω | +3.75 VDC | | 200 mW |
| | | | S 125 Ω | | | |
| | ASL-D 6 W-K | 6 VDC | P 180 Ω | +4.5 VDC | | 200 mW |
| | | | S 180 Ω | | | |
| | ASL-D 9 W-K | 9 VDC | P 405 Ω | +6.75 VDC | | 200 mW |
| | | | S 405 Ω | | | |
| ASL-D 12 W-K | 12 VDC | P 720 Ω | +9.0 VDC | | 200 mW | |
| | | S 720 Ω | | | | |
| ASL-D 18 W-K | 18 VDC | P 1,080 Ω | +13.5 VDC | | 300 mW | |
| | | S 1,080 Ω | | | | |
| ASL-D 24 W-K | 24 VDC | P 1,920 Ω | +18.0 VDC | | 300 mW | |
| | | S 1,920 Ω | | | | |

Note: *1 Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

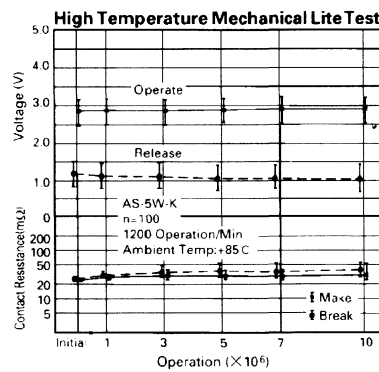
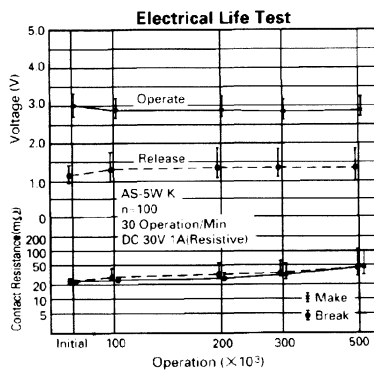
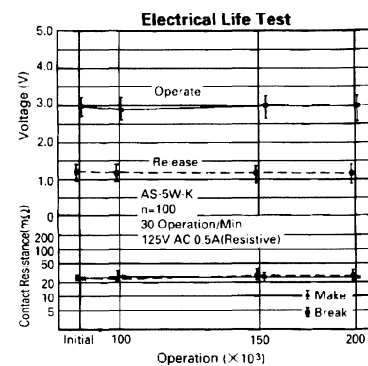
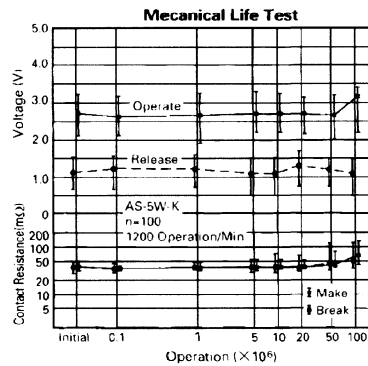
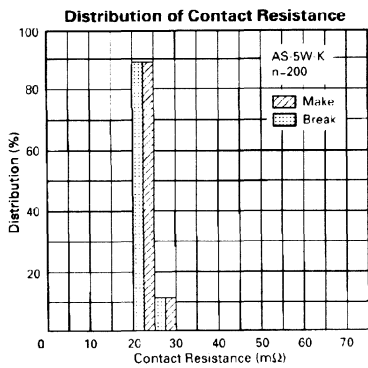
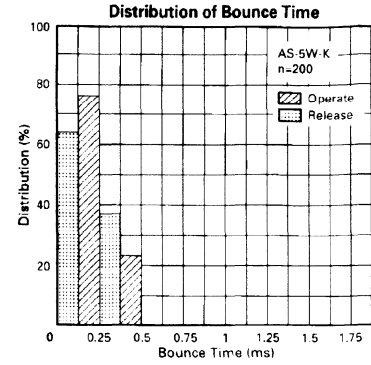
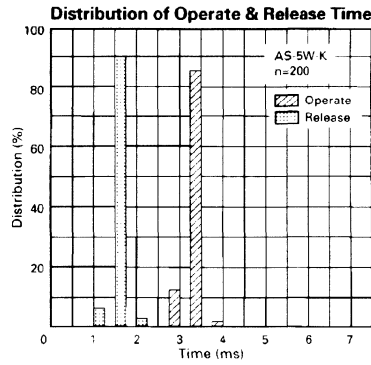
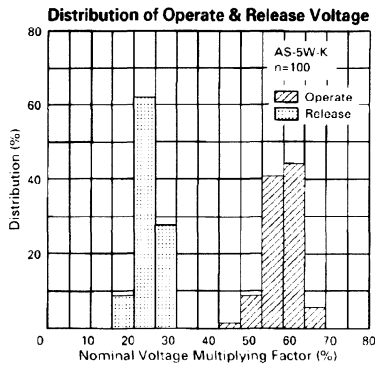
P: Primary coil S: Secondary coil

AS SERIES

CHARACTERISTIC DATA

Please see A relays.

REFERENCE DATA

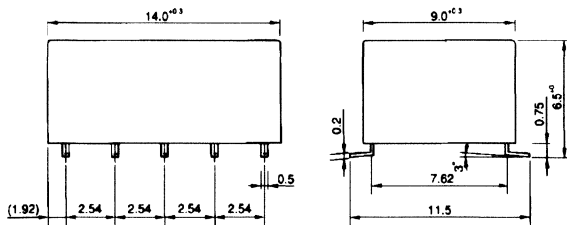


AS SERIES

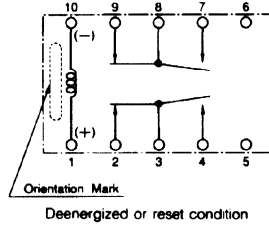
■ DIMENSIONS

● Dimensions

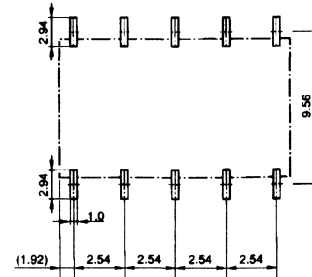
AS, ASL type (Non-latching type, single winding latching type)



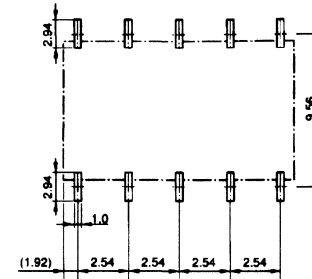
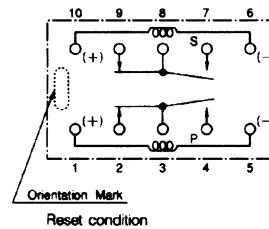
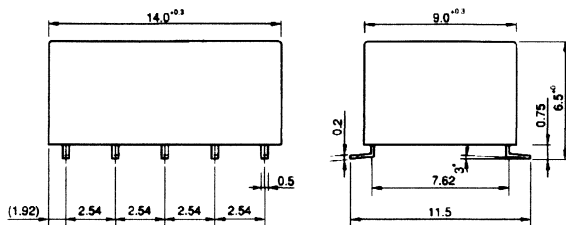
● Schematics (TOP VIEW)



● PC board mounting pad layout (TOP VIEW)



ASL-D type (Double winding latching type)

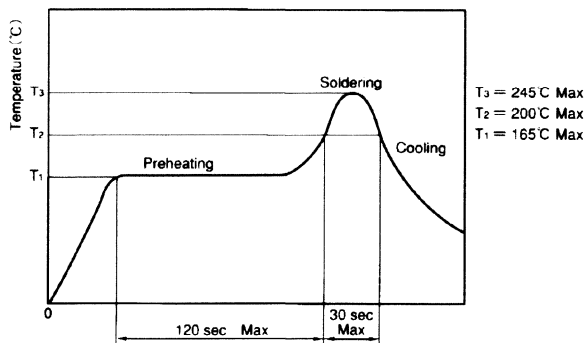


Unit: mm

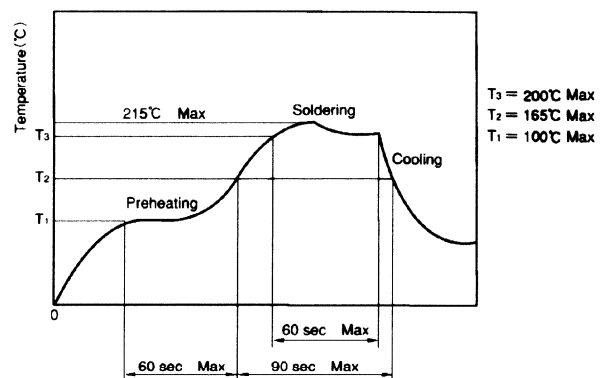
■ RECOMMENDED SOLDERING CONDITIONS

(TEMPERATURE PROFILE)

IRS (Infrared Reflow Soldering)



VPS (Vapor Phase Soldering)



- Note:
1. Temperature profiles show the temperature of the PC board surface.
 2. Please perform soldering test with your actual PC board before mass production, since the temperatures of PC board surfaces vary according to the size of PC board, status of parts mounting and heating method.

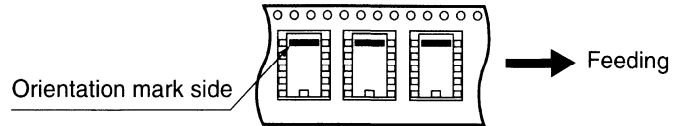
AS SERIES

■ PACKING

(1) PACKING METHOD (ONLY TAPE PACKING IS AVAILABLE)

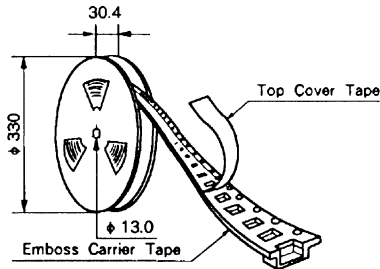
- Taping standards : JIS C 0806 and RC - 1009B (EIAJ)
- Tape type : TB2416 or TE2416
- Reel type : R24D
- Quantity of 1 reel : 500 pieces

• Packing orientation code : B

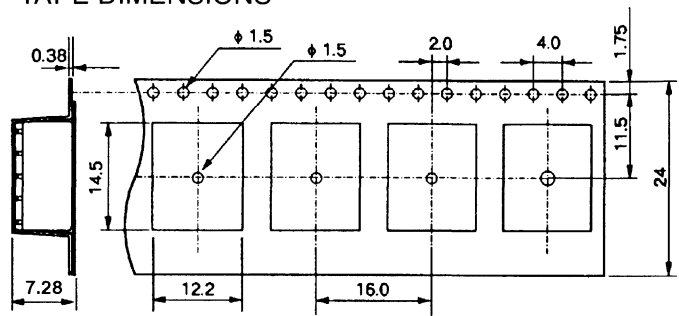


(2) DIMENSIONS (in mm)

• REEL DIMENSIONS



• TAPE DIMENSIONS



Note: Relays are sold in packs of 500 pieces, please order 500 pieces as one unit.

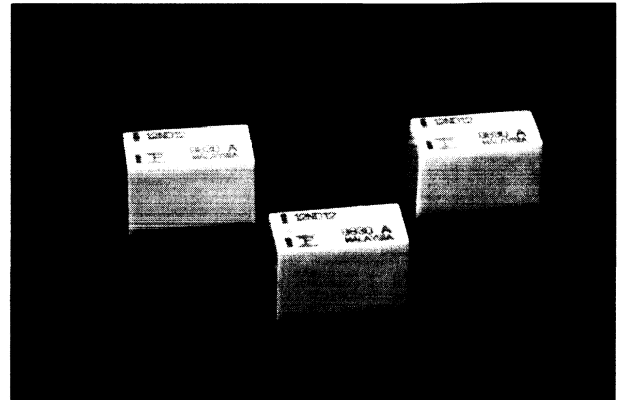
MINIATURE RELAY

2 POLES—1 to 2 A (FOR SIGNAL SWITCHING)

FBR12 SERIES

■ FEATURES

- Super miniature size: 0.2 inch x 0.1 inch grid, 12 pin DIP
Up to 50% less volume and board area than previous generation telecom relay.
- Slim type for high density mounting
- Conforms to Bellcore TR-NWT-001089 and FCC Part 68 requirements
- UL recognized and CSA certified
- Low power consumption
- Conforms to IEC 950 (W type only)
 - 2.5 mm clearance and creepage between coil and contacts
 - 5000 V surge strength between coil and contacts (2x10 μ s surge wave)
 - 2000 Vrms dielectric strength between coil and contacts
 - UL 1950 and IEC950 (approval in process)



■ ORDERING INFORMATION

[Example] FBR12 N D 12 -P -** (-CSA)
 (a) (b) (c) (d) (e) (f) (g)

| | | |
|-----|--------------------|---|
| (a) | Series Name | FBR12 : FBR12 Series |
| (b) | Enclosure | N : Standard (plastic sealed type) W : High dielectric strength type (plastic sealed type) |
| (c) | Coil Type | D : DC coil |
| (d) | Nominal Voltage | Refer to the COIL DATA CHART |
| (e) | Contact Material | Nil : Gold-overlay silver-nickel -P : Gold-overlay silver-palladium |
| (f) | Custom Designation | To be assigned custom specification |
| (g) | CSA Standard | -CSA : UL114 + CSA recognized -CSA : UL1950 + CSA (under application) |

Note: The designation name is stamped on the top of the relay case as follows:
(Example) Designation ordered: FBR12ND12
Stamp: 12ND12

FBR12 SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL114 (File No. E63615)

C22.2 No. 0, No. 14 (File No. LR40304 or LR64026)

| Nominal coil voltage | Contact rating |
|----------------------|-------------------------|
| 3 to 24 VDC | 0.5 A 125 VDC resistive |
| | 2 A 30 VDC resistive |
| | 0.3 A 110 VAC resistive |

■ SPECIFICATIONS

| Item | | Standard (Gold-overlay silver-nickel) | | -P type (Gold-overlay silver-palladium) | | |
|---------------------------|---|--|-------------------------------|---|-------------------------------|------------------|
| | | Standard | High dielectric strength type | Standard | High dielectric strength type | |
| Contact | Arrangement | 2 form C (DPDT) | | | | |
| | Material | Gold-overlay silver-nickel | | Gold-overlay silver-palladium | | |
| | Style | Bifurcated | | | | |
| | Resistance (initial) | Maximum 100 mΩ (at 0.1 A 6 VDC) | | | | |
| | Rating (resistive) | 0.5 A 125 VAC or 1 A 30 VDC | | | | |
| | Maximum Carrying Current | 2 A (at 20°C) | | | | |
| | Maximum Switching Power | 62.5 VA or 60 W | | | | |
| | Max. Switching Voltage*1 | 250 VAC or 220 VDC | | | | |
| | Maximum Switching Current | 2 A | | | | |
| | Minimum Switching Load*2 | 0.01 mA 10 VDC (reference) | | | | |
| | Capacitance (at 10 kHz) | Approximately 1.0 pF (between open contacts, adjacent contacts) Approximately 1.0 pF (between coil and contacts) | | | | |
| Coil | Nominal power (at 20°C) | Approximately 0.14 to 0.2 W | Approximately 0.23 to 0.25 W | Approximately 0.14 to 0.2 W | Approximately 0.23 to 0.25 W | |
| | Operate power (at 20°C) | Approximately 0.08 to 0.112 W | Approximately 0.13 to 0.14 W | Approximately 0.08 to 0.112 W | Approximately 0.13 to 0.14 W | |
| | Thermal Resistance at Continuous Thermal Load | Approximately 115°C/W | | | | |
| | Operating Temperature | -40°C to +85°C (no frost) (refer to the CHARACTERISTIC DATA) | | | | |
| | Operating Humidity | 45 to 85%RH | | | | |
| Time Value | Operate (at nominal voltage) | Maximum 4 msec. | | | | |
| | Release (at nominal voltage) | Maximum 4 msec. | | | | |
| | Max. Switching Frequency | Mechanical 3 Hz or electrical 0.5 Hz (at contact rating) | | | | |
| Insulation | Resistance (initial) | Minimum 1000 MΩ (at 500 VDC) | | | | |
| | Dielectric Strength | between open contacts | 1,000 VAC | | | |
| | | adjacent contacts | 1 minimum | | | |
| | | between coil and contacts | 1,500 VAC 1 min. | 2,000 VAC 1 min. | 1,500 VAC 1 min. | 2,000 VAC 1 min. |
| | Surge Strength | between open contacts, adjacent contacts | 1,500 V 10 x 700 μs | | | |
| between coil and contacts | | 2,500 V 2 x 10 μs | 5,000 V 2 x 10 μs | 2,500 V 2 x 10 μs | 5,000 V 2 x 10 μs | |

(continued)

FBR12 SERIES

(continued)

| Item | | | Standard (Gold-overlay silver-nickel) | | -P type (Gold-overlay silver-palladium) | |
|--------|--------------------------------|--|--|--|--|-------------------------------|
| | | | Standard | High dielectric strength type | Standard | High dielectric strength type |
| Life | Mechanical | | 1 x 10 operations minimum | | | |
| | Electrical (at contact rating) | DC | 200 x 10 ³ operations minimum | | 500 x 10 ³ operations minimum | |
| AC | | 100 x 10 ³ operations minimum | | 200 x 10 ³ operations minimum | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) | | | |
| | | Endurance | 10 to 55 Hz (double amplitude of 3.0 mm) | | | |
| | Shock Resistance | Misoperation | 500 m/s ² (11±1 ms) | | | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | | | |
| Weight | | Approx. 1.5 g | Approx. 1.9 g | Approx. 1.5 g | Approx. 1.9 g | |

*1 If the switching voltage exceeds the rated contact voltage, reduce the current. The current values vary according to the type of load.

*2 Values when switching a resistive load at normal room temperature and humidity and in a clean environment. The minimum switching load varies with the switching frequency and operation environment.

COIL DATA CHART

1. STANDARD

| MODEL | | Nominal voltage | Coil resistance (±10%) | Nominal current (at nominal voltage) approx. | Must operate voltage*1 | Must operate voltage*1 | Nominal power | Operate power | Coil temperature rise |
|-----------|-------------|-----------------|------------------------|--|-----------------------------|-----------------------------|-------------------------------------|---------------------|--|
| Standard | -P type | | | | | | | | |
| FBR12ND03 | FBR12ND03-P | 3 VDC | 64.3 Ω | 46 mA | 75% max. of nominal voltage | 10% min. of nominal voltage | Approx. 0.14 W (at nominal voltage) | Approx. 0.08 W Max. | Approx. 18 deg Max. (at nominal voltage) |
| FBR12ND04 | FBR12ND04-P | 4.5 VDC | 145 Ω | 31 mA | | | | | |
| FBR12ND05 | FBR12ND05-P | 5 VDC | 178 Ω | 28 mA | | | | | |
| FBR12ND06 | FBR12ND06-P | 6 VDC | 257 Ω | 23 mA | | | | | |
| FBR12ND09 | FBR12ND09-P | 9 VDC | 579 Ω | 15 mA | | | | | |
| FBR12ND12 | FBR12ND12-P | 12 VDC | 1,028 Ω | 11 mA | | | | | |
| FBR12ND24 | FBR12ND24-P | 24 VDC | 2,880 Ω | 8 mA | | | | | |

*1: Specified values are subject to pulse wave voltage.

Note: All values in the table are measured at 20°C.

2. HIGH DIELECTRIC STRENGTH

| MODEL | | Nominal voltage | Coil resistance (±10%) | Nominal current (at nominal voltage) approx. | Must operate voltage*1 | Must release voltage*1 | Nominal power | Operate power | Coil temperature rise |
|-----------|-------------|-----------------|------------------------|--|-----------------------------|-----------------------------|-------------------------------------|---------------------|-------------------------------------|
| Standard | -P type | | | | | | | | |
| FBR12WD03 | FBR12WD03-P | 3 VDC | 39 Ω | 77 mA | 75% max. of nominal voltage | 10% min. of nominal voltage | Approx. 0.23 W (at nominal voltage) | Approx. 0.13 W Max. | Approx. 30 deg (at nominal voltage) |
| FBR12WD04 | FBR12WD04-P | 4.5 VDC | 88 Ω | 51 mA | | | | | |
| FBR12WD05 | FBR12WD05-P | 5 VDC | 108 Ω | 46 mA | | | | | |
| FBR12WD06 | FBR12WD06-P | 6 VDC | 156 Ω | 38 mA | | | | | |
| FBR12WD09 | FBR12WD09-P | 9 VDC | 352 Ω | 25 mA | | | | | |
| FBR12WD12 | FBR12WD12-P | 12 VDC | 626 Ω | 19 mA | | | | | |
| FBR12WD24 | FBR12WD24-P | 24 VDC | 2,304 Ω | 10 mA | | | | | |

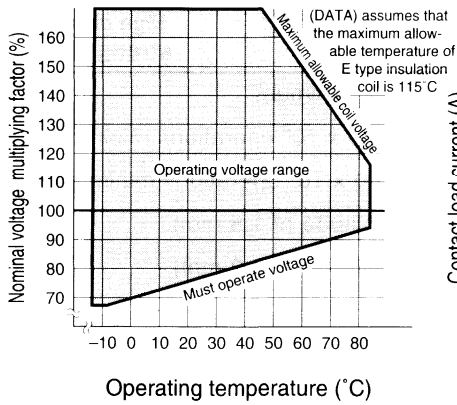
*1: Specified values are subject to pulse wave voltage.

Note: All values in the table are measured at 20°C.

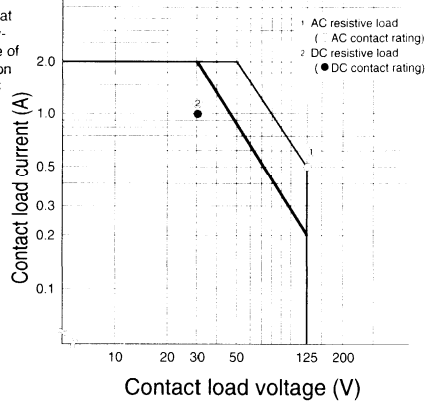
FBR12 SERIES

CHARACTERISTIC DATA

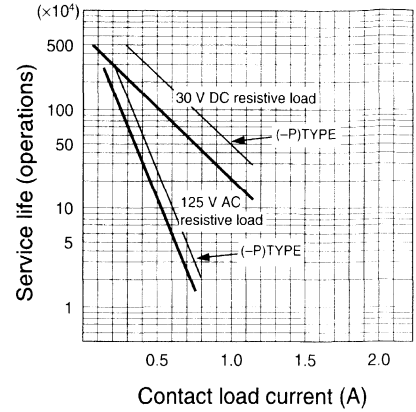
Range of operation temperature and voltage



Maximum switching capacity

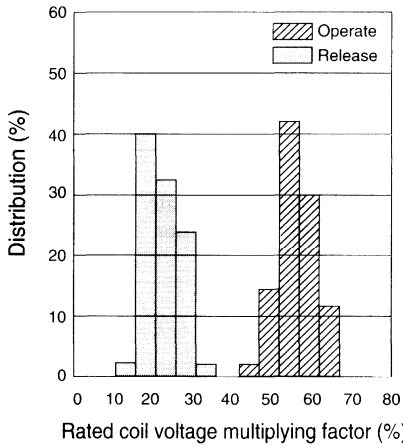


Life curve

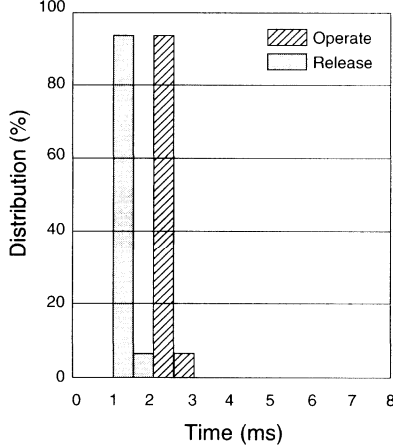


REFERENCE DATA

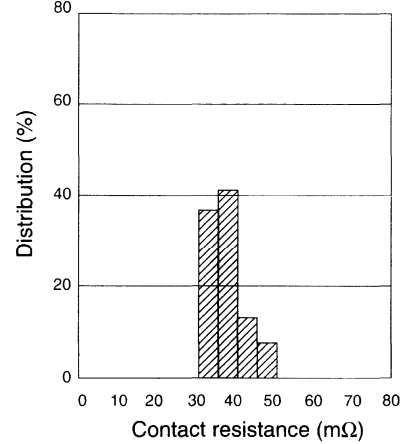
Distribution of operate and release voltage



Distribution of operate and release time

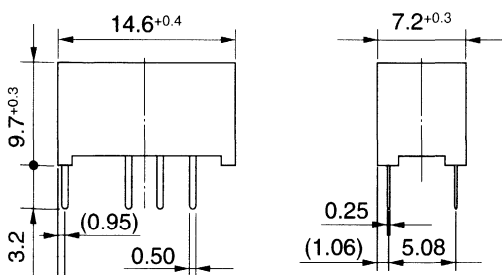


Distribution of contact resistance

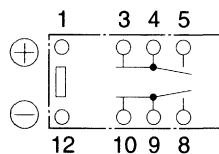


DIMENSIONS

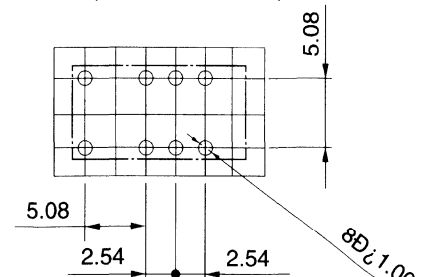
●Dimensions



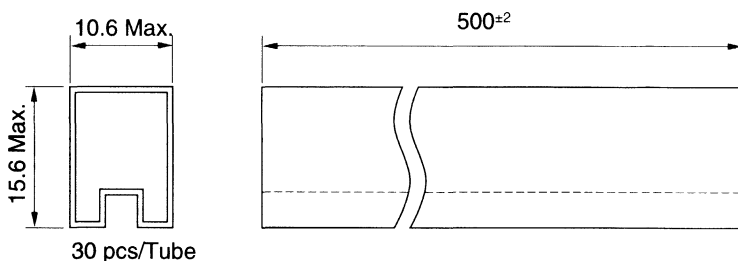
●Schematics (BOTTOM VIEW)



●PC board mounting hole layout (BOTTOM VIEW)



●Tube carrier



Unit: mm

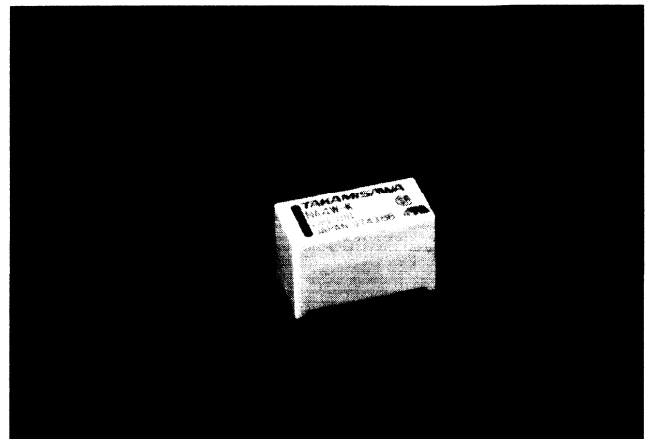
MINIATURE RELAY

2 POLES—1 to 2 A (FOR SIGNAL SWITCHING)

NA SERIES

■ FEATURES

- Slim type relay for high density mounting
- Conforms to Bellcore specification and FCC Part 68
 - Dielectric strength 1,500 VAC between coil and contacts
 - Surge strength 2,500 V between coil and contacts (at 2 x 10 μs surge wave)
- UL, CSA recognized
- High sensitivity and low consumption power
- Maximum switching capacity—4.2 A 700 VAC
- High reliability—bifurcated contacts
- DIL pitch terminals
- Plastic sealed type backfilled with nitrogen



■ ORDERING INFORMATION

[Example] NA L - D 12 W - K
 (a) (b) (*) (c) (d) (e) (f)

| | | |
|-----|--------------------|--|
| (a) | Series Name | NA : NA Series |
| (b) | Operation Function | Nil : Standard type L : Latching type |
| (c) | Number of Coil | Nil : Single winding type D : Double winding type |
| (d) | Nominal Voltage | Refer to the COIL DATA CHART |
| (e) | Contact | W : Bifurcated type |
| (f) | Enclosure | K : Plastic sealed type |

Note: Actual marking omits the hyphen (-) of (*)

■ SAFETY STANDARD AND FILE NUMBERS

UL478 (File No. E45026)

C22.2 No. 0, No. 14 (File No. LR35579)

Only UL/CSA approval markings are marked on the cover.

| Nominal voltage | Contact rating | |
|-----------------|----------------|---------|
| 1.5 to 48 VDC | 0.5 A | 125 VAC |
| | 2 A | 30 VDC |
| | 0.3 A | 110 VDC |
| | resistive | |

NA SERIES

■ SPECIFICATIONS

| Item | | Standard Type | Single Winding Latching Type | Double Winding Latching Type |
|---------------------------|--------------------------------------|---|--|------------------------------|
| | | NA-() W-K | NAL-() W-K | NAL-D () W-K |
| Contact | Arrangement | 2 form C (DPDT) | | |
| | Material | Gold overlay silver alloy | | |
| | Style | Bifurcated | | |
| | Resistance (initial) | Maximum 50 mΩ (at 1 A 6 VDC) | | |
| | Rating (resistive) | 0.5 A 125 VAC or 1 A 30 VDC | | |
| | Maximum Carrying Current | 2 A | | |
| | Maximum Switching Power | 62.5 VA, 30 W | | |
| | Maximum Switching Voltage | 250 VAC, 220 VDC | | |
| | Maximum Switching Current | 2 A | | |
| | Minimum Switching Load* ¹ | 0.01 mA 10 mVDC | | |
| | Capacitance | Approximately 1.5 pF (between open contacts, adjacent contacts) Approximately 2.0 pF (between coil and contacts) | | |
| Coil | Nominal Power (at 20°C) | 0.14 to 0.3 W | 0.1 to 0.15 W | 0.20 to 0.3 W |
| | Operate Power (at 20°C) | 0.08 to 0.17 W | 0.057 to 0.085 W | 0.113 to 0.17 W |
| | Operating Temperature | -40°C to +85°C (no frost)(refer to the CHARACTERISTIC DATA) | | |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | Maximum 6 ms (set) | |
| | Release (at nominal voltage) | Maximum 4 ms | Maximum 6 ms (reset) | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute | |
| | | between adjacent contacts | 1,000 VAC 1 minute | |
| | | between coil and contacts | 1,500 VAC 1 minute | 1,000 VAC 1 minute |
| | Surge Strength | between open contacts | 1,500 V (at 10 x 700 μs) | |
| between adjacent contacts | | 1,500 V (at 10 x 700 μs) | | |
| between coil and contacts | | 2,500 V (at 2 x 10 μs) | 1,500 V (at 10 x 160 μs) | |
| Life | Mechanical | 100 x 10 ⁶ operations minimum | 10 x 10 ⁶ operations minimum | |
| | Electrical | 200 x 10 ³ ops. min. (0.5 A 125 VAC), 500 x 10 ³ ops. min. (1 A 30 VDC) | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 3.3 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 5.0 mm) | |
| | Shock Resistance | Misoperation | 500 m/s ² (11 ±1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| | Weight | Approximately 1.5 g | | |

*¹ Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

NA SERIES

■ COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance (±10%) | Must operate voltage* ¹ | Must release voltage* ¹ | Nominal power |
|---------------|------------|-----------------|------------------------|------------------------------------|------------------------------------|---------------|
| Standard Type | NA-1.5 W-K | 1.5 VDC | 16.1 Ω | +1.13 VDC | +0.15 VDC | 140 mW |
| | NA- 3 W-K | 3 VDC | 64.3 Ω | +2.25 VDC | +0.3 VDC | 140 mW |
| | NA-4.5 W-K | 4.5 VDC | 145 Ω | +3.38 VDC | +0.45 VDC | 140 mW |
| | NA- 5 W-K | 5 VDC | 178 Ω | +3.75 VDC | +0.5 VDC | 140 mW |
| | NA- 6 W-K | 6 VDC | 257 Ω | +4.5 VDC | +0.6 VDC | 140 mW |
| | NA- 9 W-K | 9 VDC | 579 Ω | +6.75 VDC | +0.9 VDC | 140 mW |
| | NA-12 W-K | 12 VDC | 1,028 Ω | +9.0 VDC | +1.2 VDC | 140 mW |
| | NA-18 W-K | 18 VDC | 1,620 Ω | +13.5 VDC | +1.8 VDC | 200 mW |
| | NA-24 W-K | 24 VDC | 2,880 Ω | +18.0 VDC | +2.4 VDC | 200 mW |
| NA-48 W-K | 48 VDC | 7,680 Ω | +36.0 VDC | +4.8 VDC | 300 mW | |

Note: *¹ Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

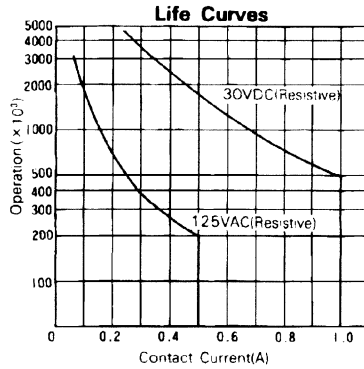
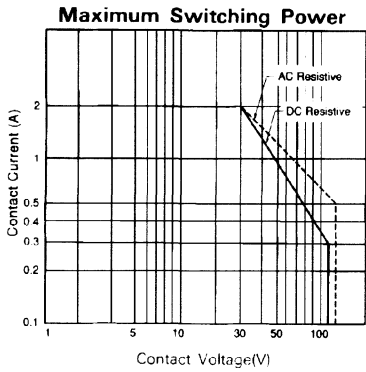
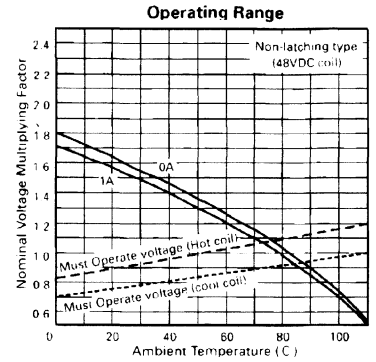
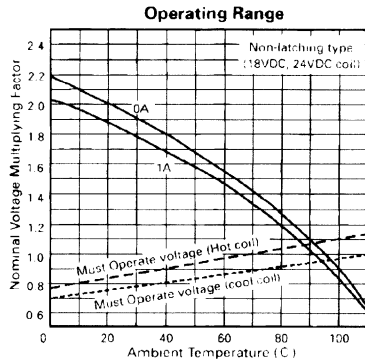
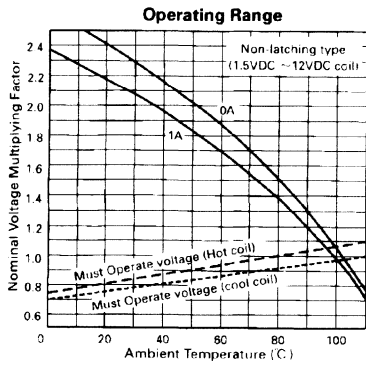
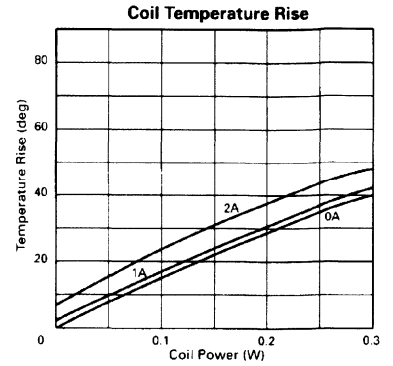
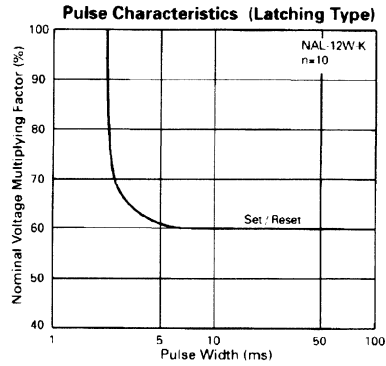
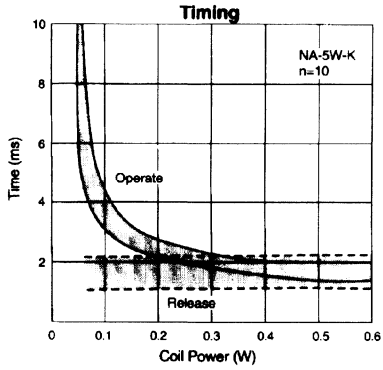
| MODEL | | Nominal voltage | Coil resistance (±10%) | Set voltage | Reset voltage | Nominal power |
|------------------------------|-------------|-----------------|------------------------|-------------|---------------|---------------|
| Single Winding Latching Type | NAL-1.5W-K | 1.5 VDC | 22.5 Ω | +1.13 VDC | -1.13 VDC | 100 mW |
| | NAL- 3 W-K | 3 VDC | 90 Ω | +2.25 VDC | -2.25 VDC | 100 mW |
| | NAL-4.5W-K | 4.5 VDC | 203 Ω | +3.38 VDC | -3.38 VDC | 100 mW |
| | NAL- 5 W-K | 5 VDC | 250 Ω | +3.75 VDC | -3.75 VDC | 100 mW |
| | NAL- 6 W-K | 6 VDC | 360 Ω | +4.5 VDC | -4.5 VDC | 100 mW |
| | NAL- 9 W-K | 9 VDC | 810 Ω | +6.75 VDC | -6.75 VDC | 100 mW |
| | NAL-12 W-K | 12 VDC | 1,440 Ω | +9.0 VDC | -9.0 VDC | 100 mW |
| | NAL-18 W-K | 18 VDC | 2,160 Ω | +13.5 VDC | -13.5 VDC | 150 mW |
| | NAL-24 W-K | 24 VDC | 3,840 Ω | +18.0 VDC | -18.0 VDC | 150 mW |
| Double Winding Latching Type | NAL-D1.5W-K | 1.5 VDC | P 11.25 Ω | +1.13 VDC | | 200 mW |
| | | | S 11.25 Ω | | +1.13 VDC | |
| | NAL-D 3 W-K | 3 VDC | P 45 Ω | +2.25 VDC | | 200 mW |
| | | | S 45 Ω | | +2.25 VDC | |
| | NAL-D4.5W-K | 4.5 VDC | P 101 Ω | +3.38 VDC | | 200 mW |
| | | | S 101 Ω | | +3.38 VDC | |
| | NAL-D 5 W-K | 5 VDC | P 125 Ω | +3.75 VDC | | 200 mW |
| | | | S 125 Ω | | +3.75 VDC | |
| | NAL-D 6 W-K | 6 VDC | P 180 Ω | +4.5 VDC | | 200 mW |
| | | | S 180 Ω | | +4.5 VDC | |
| | NAL-D 9 W-K | 9 VDC | P 405 Ω | +6.75 VDC | | 200 mW |
| | | | S 405 Ω | | +6.75 VDC | |
| NAL-D12 W-K | 12 VDC | P 720 Ω | +9.0 VDC | | 200 mW | |
| | | S 720 Ω | | +9.0 VDC | | |
| NAL-D18 W-K | 18 VDC | P 1,080 Ω | +13.5 VDC | | 300 mW | |
| | | S 1,080 Ω | | +13.5 VDC | | |
| NAL-D24 W-K | 24 VDC | P 1,920 Ω | +18.0 VDC | | 300 mW | |
| | | S 1,920 Ω | | +18.0 VDC | | |

Note: *¹ Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

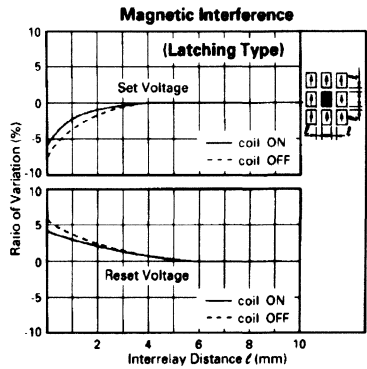
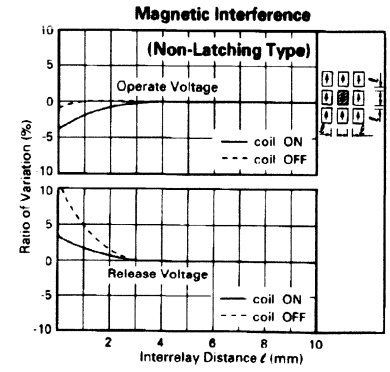
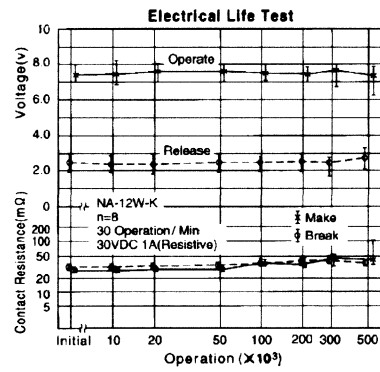
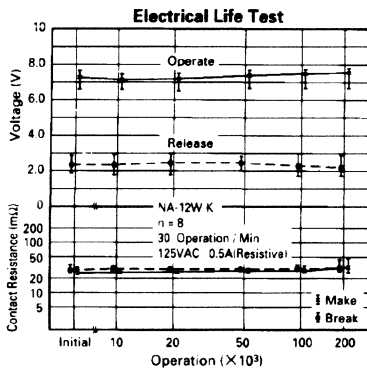
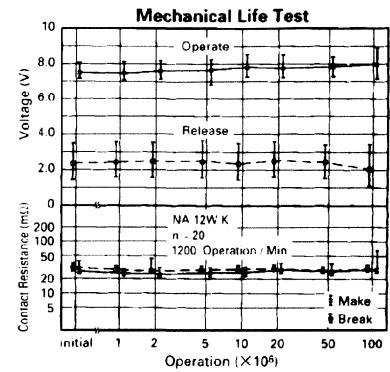
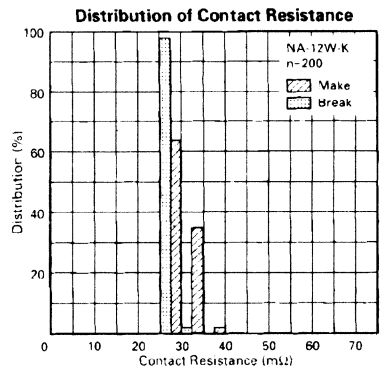
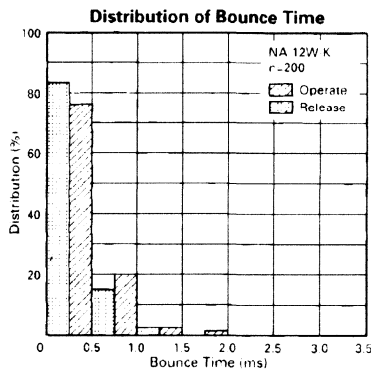
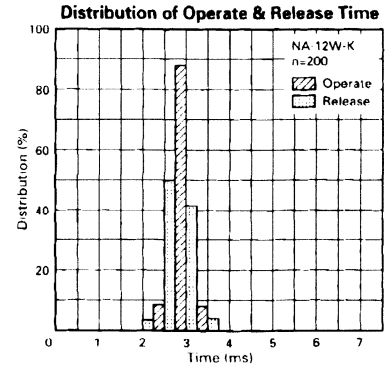
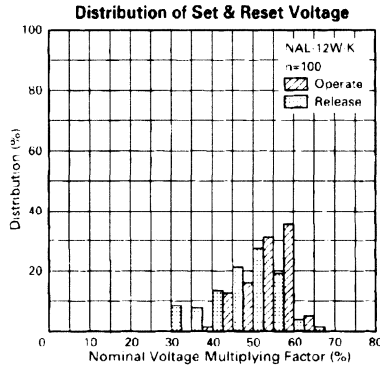
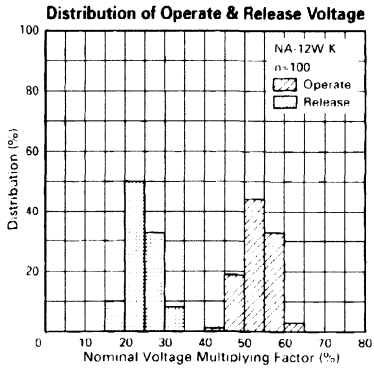
P: Primary coil S: Secondary coil

NA SERIES

CHARACTERISTIC DATA



REFERENCE DATA

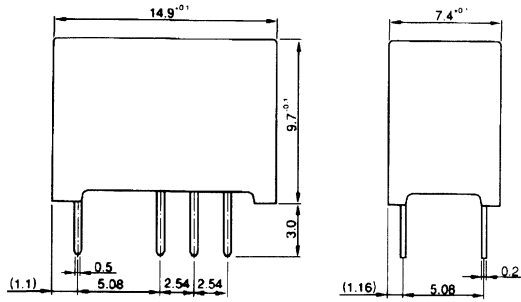


NA SERIES

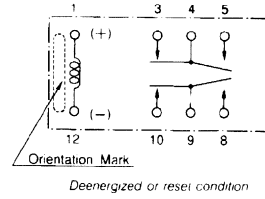
■ DIMENSIONS

● Dimensions

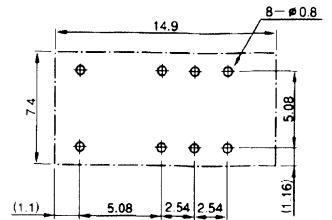
NA, NAL type (Non-latching type, single winding latching type)



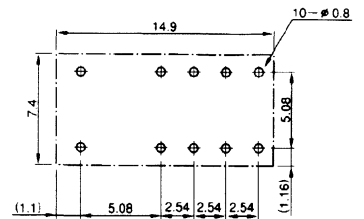
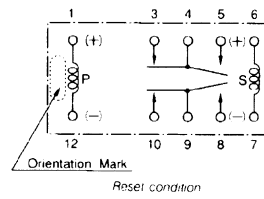
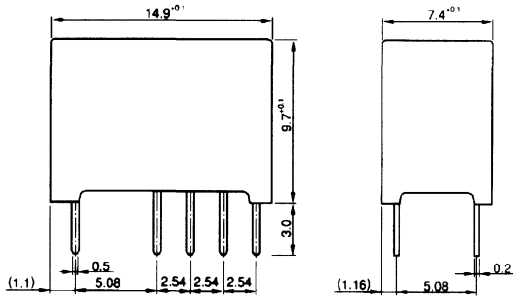
● Schematics (Bottom View)



● PC board mounting hole layout (Bottom View)



NAL-D type (double winding latching type)



Unit: mm

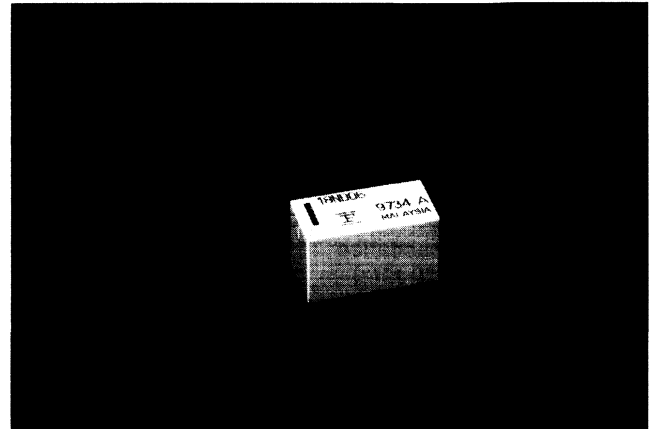
MINIATURE RELAY (SURFACE MOUNT TYPE)

2 POLES—1 to 2 A (FOR SIGNAL SWITCHING)

FBR18 SERIES

■ FEATURES

- 2 form C small size, surface mounting relay.
- Super miniature size: 0.2 inch x 0.1 inch grid, 12 pin DIP
Up to 50% less volume and board area than previous generation telecom relay.
- UL, CSA recognized.
- High dielectric and surge strength:
2.5 KV surge (per Bellcore TA-NWT-001089)
1.5 KV surge (per FCC part 68)
1,000 Vrms, open contacts
- Low power consumption: 80 mW operate
140 mW nominal
- Tape and reel packing for automatic mounting.



■ ORDERING INFORMATION

[Example] FBR18 N H D 12 -P -M -** (-CSA) - |
(a) (b) (c) (d) (e) (f) (g) (h) (i) (j)

| | | |
|-----|--------------------|--|
| (a) | Series Name | FBR18 : FBR18 Series [2 pole double throw (2 form C)] |
| (b) | Enclosure | N : Plastic sealed (washable type) |
| (c) | | H : Low power 80 mW NIL : Standard 140 mW |
| (d) | Coil Type | D : DC coil |
| (e) | Nominal Voltage | Refer to the COIL DATA CHART |
| (f) | Contact Material | Nil : Gold-overlay silver-nickel -P : Gold-overlay silver-palladium |
| (g) | Terminal | Nil : Standard -M : High density mounting |
| (h) | Custom Designation | To be assigned custom specification |
| (i) | CSA Standard | -CSA: UL114 + CSA recognized |
| (j) | Packing | Nil : Tape and reel (500 pieces/tape and reel) |

Note: The designation name is stamped on the top of the relay case as follows:

(Example) designation ordered : FBR18ND05

Stamp : 18ND05

■ SAFETY STANDARD AND FILE NUMBERS

UL114 (File No. E63615)

C22.2 No. 0, No. 14 (File No. LR40304 or LR64026)

| Nominal voltage | Contact rating |
|-----------------|-------------------------|
| 3 to 24 VDC | 2 A 30 VDC resistive |
| | 0.3 A 110 VDC resistive |
| | 0.5 A 125 VAC resistive |

FBR18 SERIES

■ SPECIFICATIONS

| Item | | Standard (Gold-overlay silver-nickel) | -P type (Gold-overlay silver-palladium) | |
|----------------|---|--|--|--|
| Contact | Arrangement | 2 form C (DPDT) | | |
| | Material | Gold-overlay silver-nickel | Gold-overlay silver-palladium | |
| | Style | Bifurcated | | |
| | Resistance (initial) | Maximum 100 mΩ (at 0.1 A 6 VDC) | | |
| | Rating (resistive) | 0.5 A 125 VAC or 1 A 30 VDC | | |
| | Maximum Carrying Current | 2 A (at 20°C) | | |
| | Maximum Switching Power | 62.5 VA or 60 W | | |
| | Max. Switching Voltage* ¹ | 250 VAC or 220 VDC | | |
| | Maximum Switching Current | 2 A | | |
| | Minimum Switching Load* ² | 0.01 mA 10 mVDC (reference) | | |
| | Capacitance (at 10 kHz) | Approximately 1.0 pF (between open contacts, adjacent contacts) Approximately 1.0 pF (between coil and contacts) | | |
| Coil | Nominal Power (at 20°C) | Approximately 0.14 W (0.2 W for 24 V coil) | | |
| | Operate Power (at 20°C) | Maximum 0.08 W (0.112 W for 24 V coil) | | |
| | Thermal Resistance at Continuous Thermal Load | Approximately 115°C/W | | |
| | Operating Temperature | -40°C to +85°C (no frost) (refer to the CHARACTERISTIC DATA) | | |
| | Operating Humidity | 45 to 85%RH | | |
| Time Value | Operate (at nominal voltage) | Maximum 4 msec. | | |
| | Release (at nominal voltage) | Maximum 4 msec. | | |
| | Max. Switching Frequency | Mechanical 3 Hz or electrical 0.5 Hz (at contact rating) | | |
| Insulation | Resistance (initial) | Minimum 1,000 MΩ (at 500 VDC) | | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minimum | |
| | | adjacent contacts | | |
| | | between coil and contacts | 1,500 VAC 1 minimum | |
| Surge Strength | between open contacts, adjacent contact | 1,500 V (at 10 x 700 μs) | | |
| | between coil and contacts | 2,500 V (at 2 x 10 μs) | | |
| Life | Mechanical | 100 x 10 ⁶ operations minimum | | |
| | Electrical (at contact rating) | DC | 200 x 10 ³ operations minimum | |
| | | AC | 100 x 10 ³ operations minimum | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 3.0 mm) | |
| | Shock Resistance | Misoperation | 500 m/s ² (11±1 ms) | |
| | | Endurance | 1,000 m/s ² (11 ±1 ms) | |
| | Weight | Approximately 1.9 g | | |

*¹ If the switching voltage exceeds the rated contact voltage, reduce the current. The current values vary according to the type of load.

*² Values when switching a resistive load at normal room temperature and humidity and in a clean atmosphere. The minimum switching load varies with the switching frequency and operation environment.

FBR18 SERIES

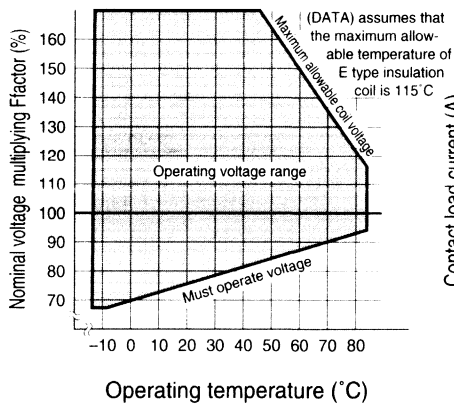
COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance ($\pm 10\%$) | Nominal current (at nominal voltage) approx. | Must operate voltage ^{*1} | Must release voltage ^{*1} | Nominal power | Operate power | Coil temperature rise |
|-----------|-------------|-----------------|--------------------------------|--|------------------------------------|------------------------------------|-------------------------------------|---------------------|-------------------------------------|
| Standard | -P type | | | | | | | | |
| FBR18ND03 | FBR18ND03-P | 3 VDC | 64.3 Ω | 46 mA | 75% max. of nominal voltage | 10% min. of nominal voltage | Approx. 0.14 W (at nominal voltage) | Approx. 0.08 W Max. | Approx. 18 deg (at nominal voltage) |
| FBR18ND04 | FBR18ND04-P | 4.5 VDC | 145 Ω | 31 mA | | | | | |
| FBR18ND05 | FBR18ND05-P | 5 VDC | 178 Ω | 28 mA | | | | | |
| FBR18ND06 | FBR18ND06-P | 6 VDC | 257 Ω | 23 mA | | | | | |
| FBR18ND09 | FBR18ND09-P | 9 VDC | 579 Ω | 15 mA | | | | | |
| FBR18ND12 | FBR18ND12-P | 12 VDC | 1,028 Ω | 11 mA | | | | | |
| FBR18ND24 | FBR18ND24-P | 24 VDC | 2,880 Ω | 8 mA | | | 0.2 W | 0.112 W | 30 deg |

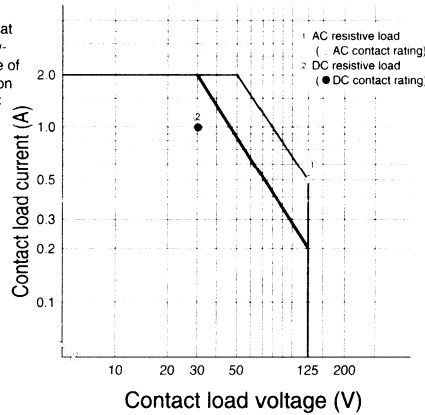
*1: Specified values are subject to pulse wave voltage.
 Note: All values in the table are measured at 20°C.

CHARACTERISTIC DATA

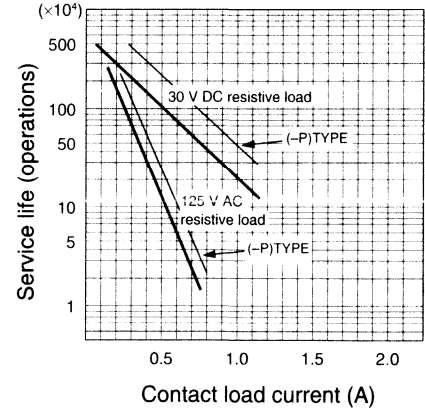
Range of operation temperature and voltage



Maximum switching capacity

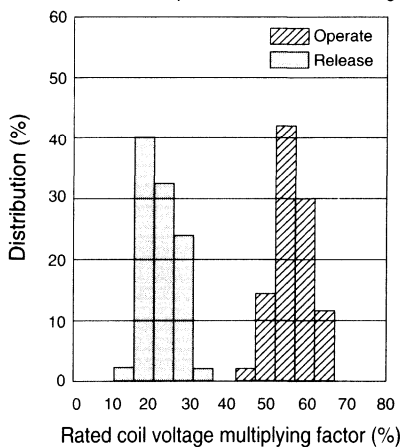


Life curve

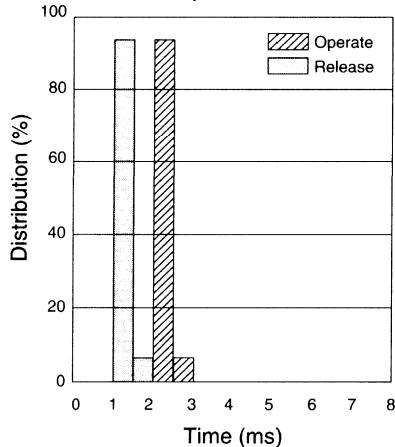


REFERENCE DATA

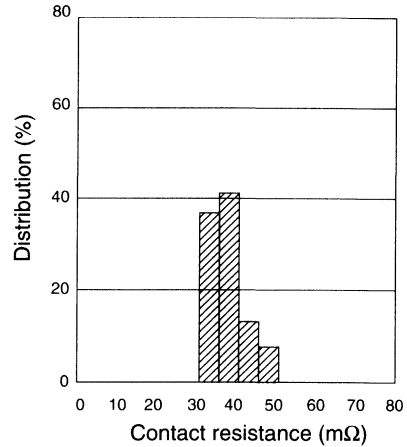
Distribution of operate and release voltage



Distribution of operate and release time



Distribution of contact resistance

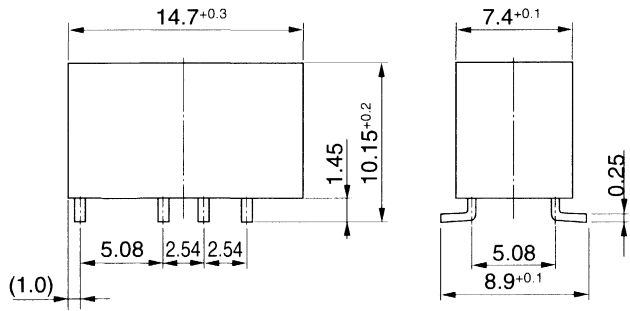


FBR18 SERIES

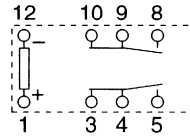
■ DIMENSIONS

●Dimensions

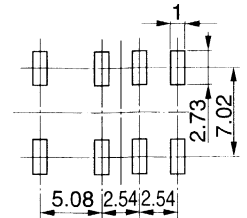
Standard (FBR18 type)



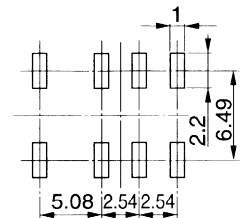
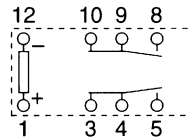
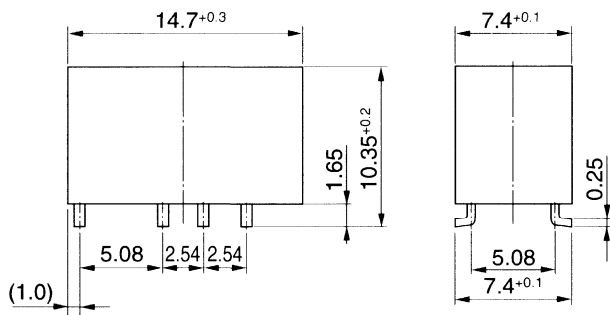
●Schematics
(TOP VIEW)



●PC board mounting pad layout
(TOP VIEW)



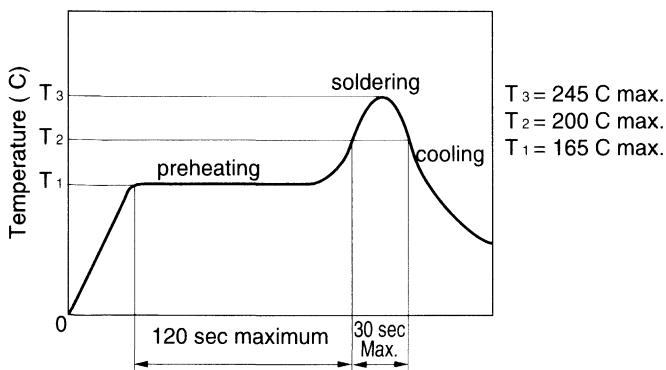
High density mounting (FBR18-M type)



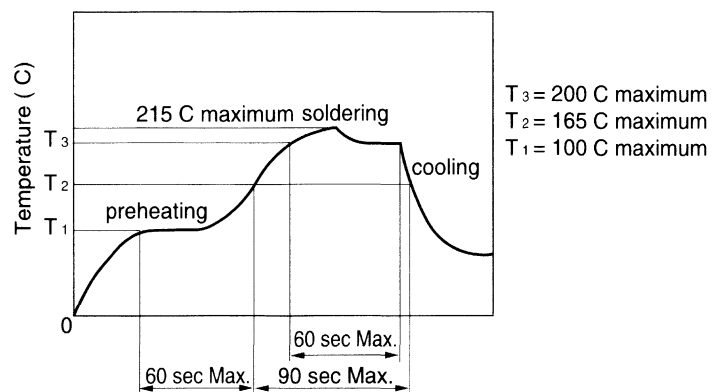
Unit: mm

■ RECOMMENDED SOLDERING CONDITIONS (TEMPERATURE PROFILE)

IRS (Infrared Reflow Soldering)



VPS (Vapor Phase Soldering)



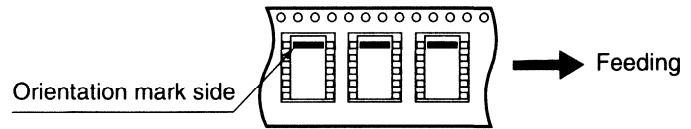
- Note:
1. Temperature profiles show the temperature of PC board surface.
 2. Please perform soldering test with your actual PC board before mass production, since the temperatures of PC board surfaces vary according to the size of PC board, status of parts mounting and heating method.

FBR18 SERIES

■ PACKING

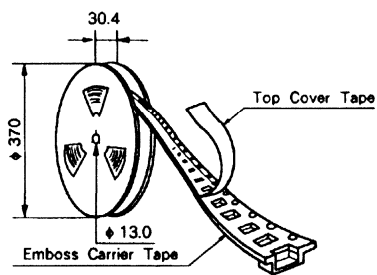
(1) Quantity of 1 reel : 500 pieces

• Packing orientation code: B

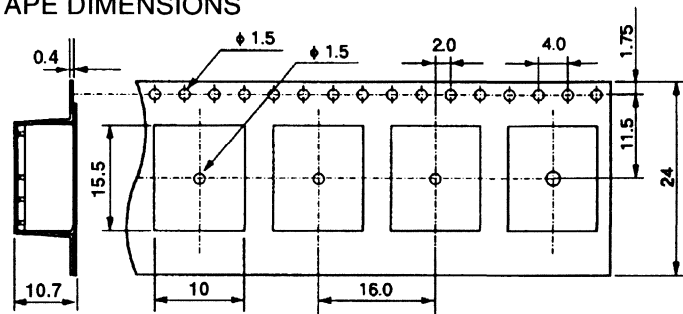


(2) Dimensions (in mm)

• REEL DIMENSIONS



• TAPE DIMENSIONS



Note: Relays are sold in packs of 500 pieces, please order 500 pieces as 1 unit.

NOTES

A large rectangular area with rounded corners, intended for handwritten notes. It is connected to the 'NOTES' label by a line that starts from the right side of the oval, goes horizontally to the right, then vertically down, then horizontally left, and finally vertically up to the top-left corner of the rectangle.

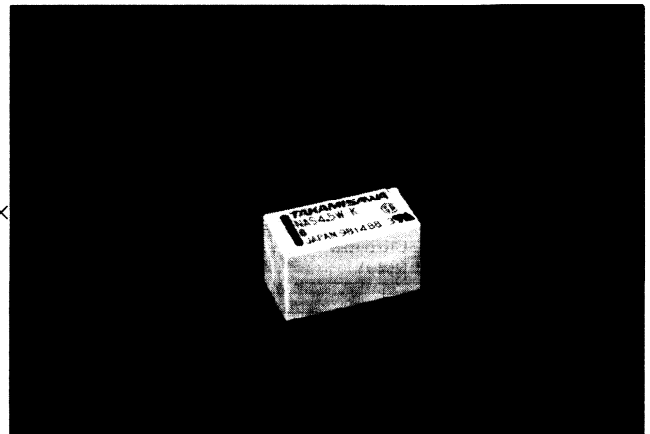
MINIATURE RELAY (SURFACE MOUNT TYPE)

2 POLES—1 to 2 A (FOR SIGNAL SWITCHING)

NAS SERIES

■ FEATURES

- 2 form C small size, surface mounting relay
- Slim type relay for high density mounting
- Conforms to Bellcore specification and FCC part 68
 - Dielectric strength 1,500 VAC between coil and contacts
 - Surge strength 2,500 V between coil and contacts (at 2 × 10 μs surge wave)
- UL, CSA recognized
- High sensitivity and low consumption power
 - Operating power: 57~170 mW
 - Nominal power: 100~300 mW
- High reliability—bifurcated contacts
- DIL pitch terminals
- Plastic sealed type backfilled with nitrogen



■ ORDERING INFORMATION

[Example] NAS L - D 12 W - K
 (a) (b) (*) (c) (d) (e) (f)

| | | |
|-----|--------------------|--|
| (a) | Series Name | NAS : NAS Series |
| (b) | Operation Function | Nil : Standard type L : Latching type |
| (c) | Number of Coil | Nil : Single winding type D : Double winding type |
| (d) | Nominal Voltage | Refer to the COIL DATA CHART |
| (e) | Contact | W : Bifurcated type |
| (f) | Enclosure | K : Plastic sealed type |

Note: Actual marking omits the hyphen (-) of (*)

■ SAFETY STANDARD AND FILE NUMBERS

UL478 (File No. E45026)

C22.2 No. 14 (File No. LR35579)

Only UL/CSA approval markings are marked on the cover.

| Nominal voltage | Contact rating | |
|-----------------|----------------|---------|
| 1.5 to 48 VDC | 0.5 A | 125 VAC |
| | 2 A | 30 VDC |
| | 0.3 A | 110 VDC |

resistive

NAS SERIES

■ SPECIFICATIONS

| Item | | Standard Type | Single Winding Latching Type | Double Winding Latching Type |
|---------------------------|------------------------------|---|--|------------------------------|
| | | NAS-() W-K | NASL-() W-K | NASL-D () W-K |
| Contact | Arrangement | 2 form C (DPDT) | | |
| | Material | Gold overlay silver alloy | | |
| | Style | Bifurcated | | |
| | Resistance (initial) | Maximum 50 mΩ (at 1 A 6 VDC) | | |
| | Rating (resistive) | 0.5 A 125 VAC or 1 A 30 VDC | | |
| | Maximum Carrying Current | 2 A | | |
| | Maximum Switching Power | 62.5 VA, 30 W | | |
| | Maximum Switching Voltage | 250 VAC, 220 VDC | | |
| | Maximum Switching Current | 2 A | | |
| | Minimum Switching Load*1 | 0.01 mA 10 mVDC | | |
| | Capacitance (at 1 kHz) | Approximately 1.5 pF (between open contacts, adjacent contacts) Approximately 2.0 pF (between coil and contacts) | | |
| Coil | Nominal Power (at 20°C) | 0.14 to 0.3 W | 0.1 to 0.15 W | 0.20 to 0.3 W |
| | Operate Power (at 20°C) | 0.08 to 0.17 W | 0.057 to 0.085 W | 0.113 to 0.17 W |
| | Operating Temperature | -40°C to +85°C (no frost)(refer to the CHARACTERISTING DATA) | | |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | Maximum 6 ms (set) | |
| | Release (at nominal voltage) | Maximum 4 ms | Maximum 6 ms (reset) | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute | |
| | | between adjacent contacts | 1,000 VAC 1 minute | |
| | | between coil and contacts | 1,500 VAC 1 minute | 1,000 VAC 1 minute |
| | Surge Strength | between open contacts | 1,500 V (at 10 x 700 μs) | |
| | | between adjacent contacts | 1,500 V (at 10 x 700 μs) | |
| between coil and contacts | | 2,500 V (at 2 x 10 μs) | 1,500 V (at 10 x 160 μs) | |
| Life | Mechanical | 100 x 10 ⁶ operations minimum | 10 x 10 ⁶ operations minimum | |
| | Electrical | 200 x 10 ³ ops. min. (0.5 A 125 VAC), 500 x 10 ³ ops. min. (1 A 30 VDC) | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 3.3 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 5.0 mm) | |
| | Shock Resistance | Misoperation | 500 m/s ² (11 ±1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| | Weight | Approximately 1.8 g | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

NAS SERIES

■ COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance (±10%) | Must operate voltage* ¹ | Must release voltage* ¹ | Nominal power |
|---------------|-------------|-----------------|------------------------|------------------------------------|------------------------------------|---------------|
| Standard Type | NAS-1.5 W-K | 1.5 VDC | 16.1 Ω | +1.13 VDC | +0.15 VDC | 140 mW |
| | NAS- 3 W-K | 3 VDC | 64.3 Ω | +2.25 VDC | +0.3 VDC | 140 mW |
| | NAS-4.5 W-K | 4.5 VDC | 145 Ω | +3.38 VDC | +0.45 VDC | 140 mW |
| | NAS- 5 W-K | 5 VDC | 178 Ω | +3.75 VDC | +0.5 VDC | 140 mW |
| | NAS- 6 W-K | 6 VDC | 257 Ω | +4.5 VDC | +0.6 VDC | 140 mW |
| | NAS- 9 W-K | 9 VDC | 579 Ω | +6.75 VDC | +0.9 VDC | 140 mW |
| | NAS- 12 W-K | 12 VDC | 1,028 Ω | +9.0 VDC | +1.2 VDC | 140 mW |
| | NAS- 18 W-K | 18 VDC | 1,620 Ω | +13.5 VDC | +1.8 VDC | 200 mW |
| | NAS- 24 W-K | 24 VDC | 2,880 Ω | +18.0 VDC | +2.4 VDC | 200 mW |
| NAS- 48 W-K | 48 VDC | 7,680 Ω | +36.0 VDC | +4.8 VDC | 300 mW | |

Note: *¹ Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

| MODEL | | Nominal voltage | Coil resistance (±10%) | Set voltage* ¹ | Reset voltage* ¹ | Nominal power |
|------------------------------|---------------|-----------------|------------------------|---------------------------|-----------------------------|---------------|
| Single Winding Latching Type | NASL-1.5 W-K | 1.5 VDC | 22.5 Ω | +1.13 VDC | -1.13 VDC | 100 mW |
| | NASL- 3 W-K | 3 VDC | 90 Ω | +2.25 VDC | -2.25 VDC | 100 mW |
| | NASL-4.5 W-K | 4.5 VDC | 203 Ω | +3.38 VDC | -3.38 VDC | 100 mW |
| | NASL- 5 W-K | 5 VDC | 250 Ω | +3.75 VDC | -3.75 VDC | 100 mW |
| | NASL- 6 W-K | 6 VDC | 360 Ω | +4.5 VDC | -4.5 VDC | 100 mW |
| | NASL- 9 W-K | 9 VDC | 810 Ω | +6.75 VDC | -6.75 VDC | 100 mW |
| | NASL- 12 W-K | 12 VDC | 1,440 Ω | +9.0 VDC | -9.0 VDC | 100 mW |
| | NASL- 18 W-K | 18 VDC | 2,160 Ω | +13.5 VDC | -13.5 VDC | 150 mW |
| | NASL- 24 W-K | 24 VDC | 3,840 Ω | +18.0 VDC | -18.0 VDC | 150 mW |
| Double Winding Latching Type | NASL-D1.5 W-K | 1.5 VDC | P 11.25 Ω | +1.13 VDC | +1.13 VDC | 200 mW |
| | | | S 11.25 Ω | | | |
| | NASL-D 3 W-K | 3 VDC | P 45 Ω | +2.25 VDC | +2.25 VDC | 200 mW |
| | | | S 45 Ω | | | |
| | NASL-D4.5 W-K | 4.5 VDC | P 101 Ω | +3.38 VDC | +3.38 VDC | 200 mW |
| | | | S 101 Ω | | | |
| | NASL-D 5 W-K | 5 VDC | P 125 Ω | +3.75 VDC | +3.75 VDC | 200 mW |
| | | | S 125 Ω | | | |
| | NASL-D 6 W-K | 6 VDC | P 180 Ω | +4.5 VDC | +4.5 VDC | 200 mW |
| | | | S 180 Ω | | | |
| | NASL-D 9 W-K | 9 VDC | P 405 Ω | +6.75 VDC | +6.75 VDC | 200 mW |
| | | | S 405 Ω | | | |
| NASL-D 12 W-K | 12 VDC | P 720 Ω | +9.0 VDC | +9.0 VDC | 200 mW | |
| | | S 720 Ω | | | | |
| NASL-D 18 W-K | 18 VDC | P 1,080 Ω | +13.5 VDC | +13.5 VDC | 300 mW | |
| | | S 1,080 Ω | | | | |
| NASL-D 24 W-K | 24 VDC | P 1,920 Ω | +18.0 VDC | +18.0 VDC | 300 mW | |
| | | S 1,920 Ω | | | | |

Note: *¹ Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

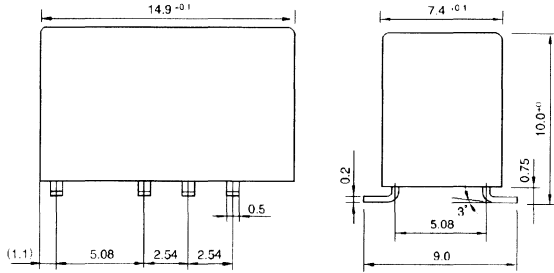
P: Primary coil S: Secondary coil

NAS SERIES

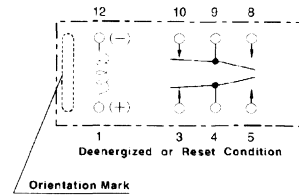
■ DIMENSIONS

● Dimensions

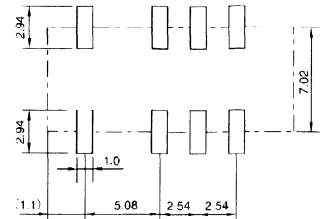
NAS, NASL type (Non-latching type, single winding latching type)



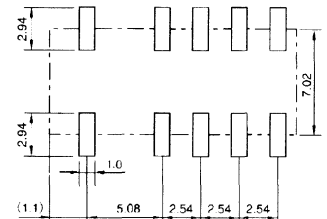
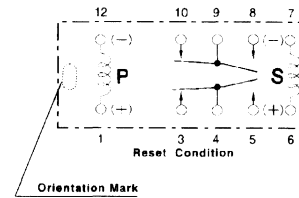
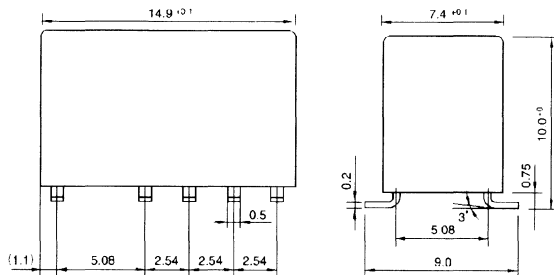
● Schematics (top view)



● PC board mounting pad layout (top view)



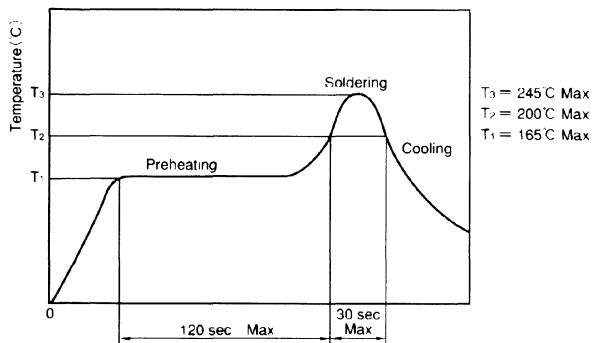
NASL-D type (Double winding latching type)



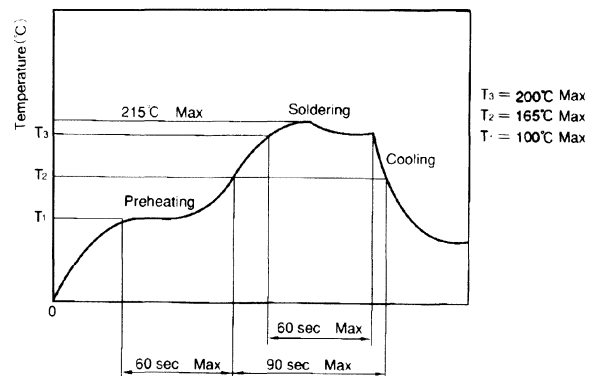
Unit: mm

■ RECOMMENDED SOLDERING CONDITIONS (TEMPERATURE PROFILE)

IRS (Infrared Reflow Soldering)



VPS (Vapor Phase Soldering)



- Note:
1. Temperature profiles show the temperature of PC board surface.
 2. Please perform soldering test with your actual PC board before mass production, since the temperatures of PC board surfaces vary according to the size of PC board, status of parts mounting and heating method.

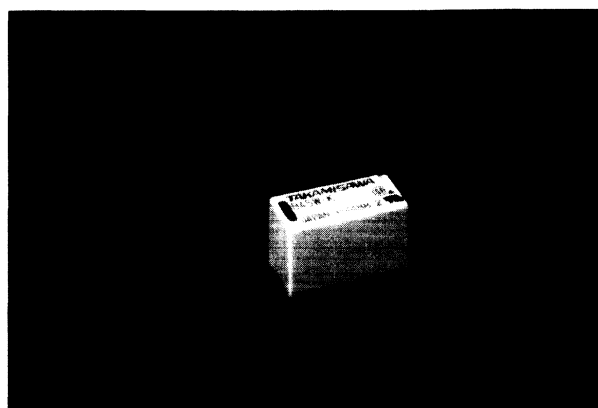
MINIATURE RELAY

2 POLES —1 to 2A (FOR SIGNAL SWITCHING

BA SERIES

■ FEATURES

- Slim type relay for high density mounting
- CSA recognized
- Conforms to IEC950, Bellcore specification and FCC Part 68
 - Clearance and creepage distance 2.5 mm between coil and contacts
 - Dielectric strength 2,000 VAC between coil and contacts
 - Surge strength 3,000 V between coil and contacts (at 2 x 10 μs surge wave)
- High sensitivity and low consumption power
- Latching type available
- High reliability—bifurcated contacts
- Plastic sealed type backfilled with nitrogen
- Conforms to UL (under approval)



■ ORDERING INFORMATION

[Example] BA L - D 12 W - K
 (a) (b) (*) (c) (d) (e) (f)

| | | |
|-----|--------------------|---|
| (a) | Series Name | BA : BA Series |
| (b) | Operation Function | Nil : Standard type L : Latching type (without MBB type) |
| (c) | Number of Coil | Nil : Single winding type D : Double winding type (without MBB type) |
| (d) | Nominal Voltage | Refer to the COIL DATA CHART |
| (e) | Contact | W : Bifurcated type |
| (f) | Enclosure | K : Plastic sealed type |

Note: Actual marking omits the hyphen (-) of (+)

■ SAFETY STANDARD AND FILE NUMBERS

CSA CERTIFIED NRTL/C to C22.2 No. 14 No. 950 (File No. LR35579), UL 1950 (File No. E45026)

| Relay type | Nominal voltage | Contact rating | |
|------------|-----------------|----------------|---------|
| BA | 1.5 to 48 VDC | 0.5 A | 125 VAC |
| BAL | | 2 A | 30 VDC |
| BALD | | 0.3 A | 110 VDC |
| | | resistive | |

BA SERIES

■ SPECIFICATIONS

| Item | | Standard | Single Winding Latching Type | Double Winding Latching |
|----------------|-------------------------------------|---|--|-------------------------|
| | | BA-() W-K | BAL-() W-K | BAL-D () W-K |
| Contact | Arrangement | 2 form C (DPDT) | | |
| | Material | Gold overlay silver alloy | | |
| | Style | Bifurcated | | |
| | Resistance (initial) (at 1 A 6 VDC) | Maximum 50 mΩ | | |
| | Rating (resistive) | 0.5 A 125 VAC or 1 A 30 VDC | | |
| | Maximum Carrying Current | 2 A | | |
| | Maximum Switching Power | 62.5 VA, 30 W | | |
| | Maximum Switching Voltage | 125 VAC, 110 VDC | | |
| | Maximum Switching Current | 2 A | | |
| | Minimum Switching Load*1 | 0.01 mA 10 mVDC | | |
| | Capacitance | Approximately 1.5 pF (between open contacts, adjacent contacts) Approximately 2.0 pF (between coil and contacts) | | |
| Coil | Nominal Power (at 20°C) | 0.25 to 0.36 W | 0.2 W | 0.36 W |
| | Operate Power (at 20°C) | 0.14 to 0.2 W | 0.11 W | 0.17 to 0.2 W |
| | Operating Temperature | -40°C to +70°C (no frost) (refer to the CHARACTERISTIC DATA) | | |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | Maximum 6 ms (set) | |
| | Release (at nominal voltage) | Maximum 4 ms | Maximum 6 ms (reset) | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute | |
| | | between adjacent contacts | | |
| | | between coil and contacts | 2,000 VAC 1 minute | 1,000 VAC 1 minute |
| Surge Strength | 3,000 V (at 2 x 10 μs) | 1,500 V (at 10 x 160 μs) | | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | | |
| | Electrical | 200 x 10 ³ operations minimum (0.5 A 125 VAC) 500 x 10 ³ operations minimum (1 A 30 VDC) | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 3.3 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 5.0 mm) | |
| | Shock Resistance | Misoperation | 500 m/s ² (11 ±1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| Weight | Approximately 1.9 g | | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

BA SERIES

COIL DATA CHART

| | MODEL | Nominal voltage | Coil resistance ($\pm 10\%$) | Must operate voltage*1 | Must release voltage*1 | Nominal power |
|---------------|------------|-----------------|--------------------------------|------------------------|------------------------|---------------|
| Standard Type | BA-1.5 W-K | 1.5 VDC | 9 Ω | +1.13 VDC | +0.15 VDC | 250 mW |
| | BA- 3 W-K | 3 VDC | 36 Ω | +2.25 VDC | +0.3 VDC | 250 mW |
| | BA-4.5 W-K | 4.5 VDC | 81 Ω | +3.38 VDC | +0.45 VDC | 250 mW |
| | BA- 5 W-K | 5 VDC | 100 Ω | +3.75 VDC | +0.5 VDC | 250 mW |
| | BA- 6 W-K | 6 VDC | 144 Ω | +4.5 VDC | +0.6 VDC | 250 mW |
| | BA- 9 W-K | 9 VDC | 324 Ω | +6.75 VDC | +0.9 VDC | 250 mW |
| | BA- 12 W-K | 12 VDC | 576 Ω | +9.0 VDC | +1.2 VDC | 250 mW |
| | BA- 18 W-K | 18 VDC | 1,296 Ω | +13.5 VDC | +1.8 VDC | 250 mW |
| | BA- 24 W-K | 24 VDC | 2,304 Ω | +18.0 VDC | +2.4 VDC | 250 mW |
| | BA- 48 W-K | 48 VDC | 6,400 Ω | +36.0 VDC | +4.8 VDC | 360 mW |

Note: *1 Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

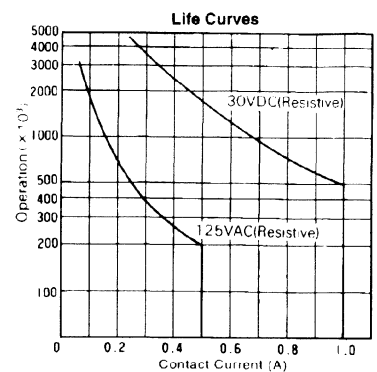
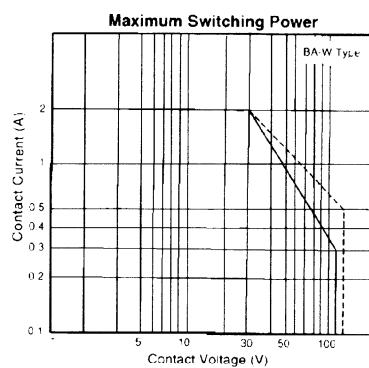
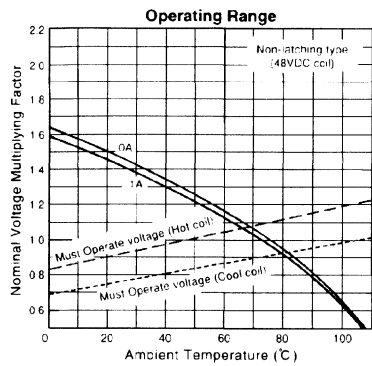
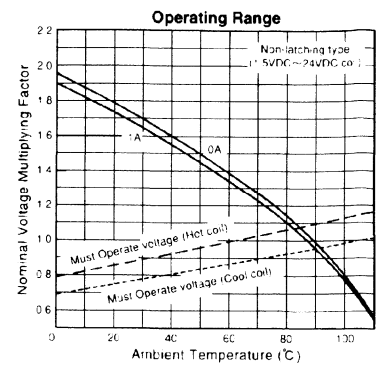
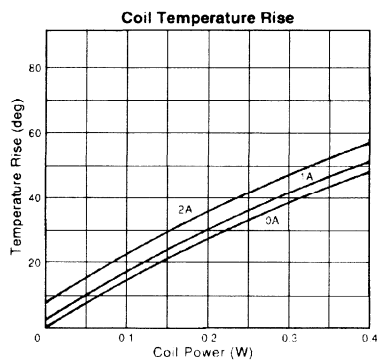
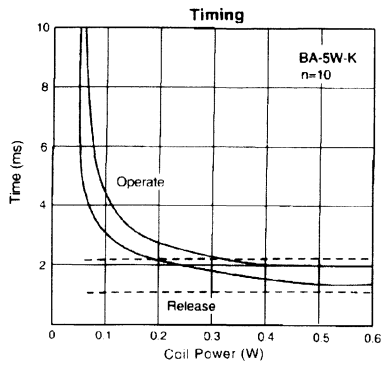
| | MODEL | Nominal voltage | Coil resistance ($\pm 10\%$) | Set voltage*1 | Reset voltage*1 | Nominal power |
|------------------------------|--------------|------------------|--------------------------------|---------------|-----------------|---------------|
| Single Winding Latching Type | BAL-1.5 W-K | 1.5 VDC | 11.25 Ω | +1.13 VDC | -1.13 VDC | 200 mW |
| | BAL- 3 W-K | 3 VDC | 45 Ω | +2.25 VDC | -2.25 VDC | 200 mW |
| | BAL-4.5 W-K | 4.5 VDC | 101 Ω | +3.38 VDC | -3.38 VDC | 200 mW |
| | BAL- 5 W-K | 5 VDC | 125 Ω | +3.75 VDC | -3.75 VDC | 200 mW |
| | BAL- 6 W-K | 6 VDC | 180 Ω | +4.5 VDC | -4.5 VDC | 200 mW |
| | BAL- 9 W-K | 9 VDC | 405 Ω | +6.75 VDC | -6.75 VDC | 200 mW |
| | BAL- 12 W-K | 12 VDC | 720 Ω | +9.0 VDC | -9.0 VDC | 200 mW |
| | BAL- 18 W-K | 18 VDC | 1,620 Ω | +13.5 VDC | -13.5 VDC | 200 mW |
| | BAL- 24 W-K | 24 VDC | 2,880 Ω | +18.0 VDC | -18.0 VDC | 200 mW |
| Double Winding Latching Type | BAL-D1.5 W-K | 1.5 VDC | P 6.25 Ω | +1.13 VDC | | 360 mW |
| | | | S 6.25 Ω | | +1.13 VDC | |
| | BAL-D 3 W-K | 3 VDC | P 25 Ω | +2.25 VDC | | 360 mW |
| | | | S 25 Ω | | +2.25 VDC | |
| | BAL-D4.5 W-K | 4.5 VDC | P 56.3 Ω | +3.38 VDC | | 360 mW |
| | | | S 56.3 Ω | | +3.38 VDC | |
| | BAL-D 5 W-K | 5 VDC | P 69.4 Ω | +3.75 VDC | | 360 mW |
| | | | S 69.4 Ω | | +3.75 VDC | |
| | BAL-D 6 W-K | 6 VDC | P 100 Ω | +4.5 VDC | | 360 mW |
| | | | S 100 Ω | | +4.5 VDC | |
| | BAL-D 9 W-K | 9 VDC | P 225 Ω | +6.75 VDC | | 360 mW |
| | | | S 225 Ω | | +6.75 VDC | |
| BAL-D 12 W-K | 12 VDC | P 400 Ω | +9.0 VDC | | 360 mW | |
| | | S 400 Ω | | +9.0 VDC | | |
| BAL-D 18 W-K | 18 VDC | P 900 Ω | +13.5 VDC | | 360 mW | |
| | | S 900 Ω | | +13.5 VDC | | |
| BAL-D 24 W-K | 24 VDC | P 1,600 Ω | +18.0 VDC | | 360 mW | |
| | | S | | | | |

Note: *1 Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

P: Primary coil S: Secondary coil

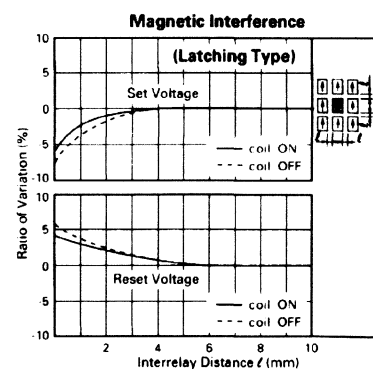
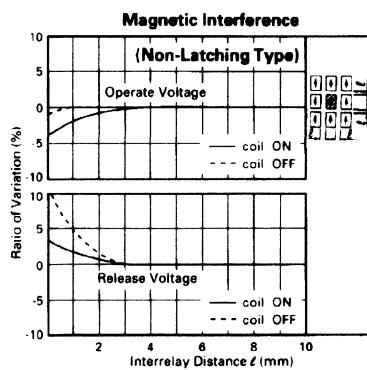
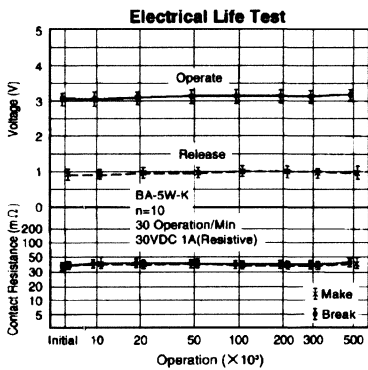
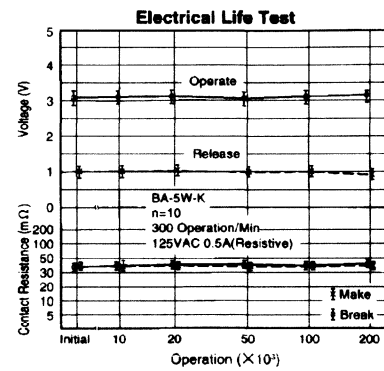
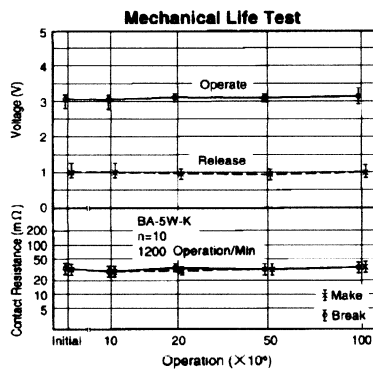
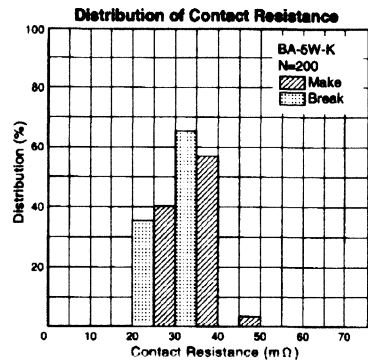
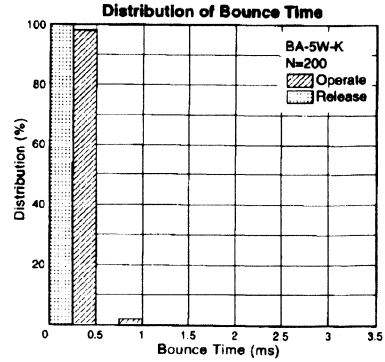
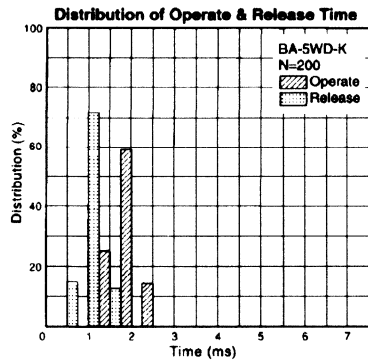
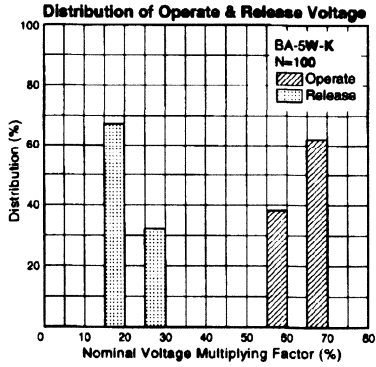
BA SERIES

CHARACTERISTIC DATA



BA SERIES

REFERENCE DATA

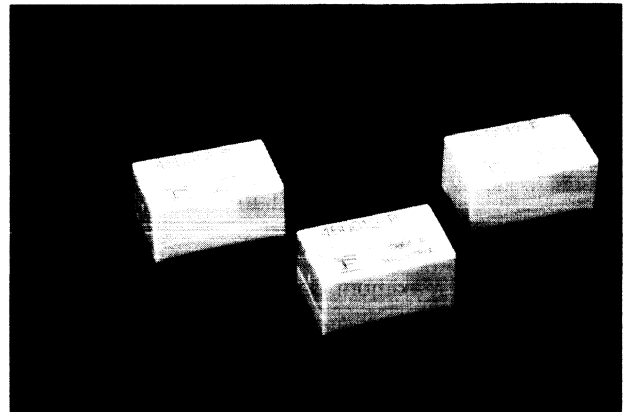


MINIATURE RELAY

2 POLES—1 to 2 A (FOR SIGNAL SWITCHING) FBR46 SERIES

■ FEATURES

- Miniature size
About 50% smaller in volume compared with the FBR240 series used mainly in communication equipment.
- High surge voltage
2,500 V minimum of surge strength (Bellcore standard), and 1,500 VAC minimum of dielectric strength between coil and contact (-15, -16 type).
- Low power consumption
85 mW of operate power (150 mW of nominal power consumption) by built-in permanent magnet.
- Shipping tube package



■ ORDERING INFORMATION

[Example] FBR46 N D 012 -P -15 -CSA
(a) (b) (+) (c) (d) (e) (f)

| | | |
|-----|----------------------|---|
| (a) | Series Name | FBR46 : FBR46 Series |
| (b) | Enclosure | N : Plastic sealed |
| (c) | Coil Type | D : Standard, -15, -16 (DC coil) G : 65% Operate type L1 : Single winding latching type L2 : Double winding latching type (refer to the SPECIFICATIONS) |
| (d) | Nominal Voltage | (Example) Standard, -15, -16 type (Example) Latching type 005: 5 VDC 05: 5 VDC 012: 12 VDC 12: 12 VDC (refer to the COIL DATA CHART) |
| (e) | Contact Material | -P : Gold-overlay silver-palladium |
| (f) | Dielectric Strength | Nil : Between coil and contacts 1,000 VAC, between contacts 750 VAC -15 : Between coil and contacts 1,500 VAC, between contacts 750 VAC -16 : Between coil and contacts 1,500 VAC, between contacts 1,000 VAC |
| (g) | Safety Specification | Nil : Standard (UL114 recognized) -CSA : UL114 + CSA recognized |

Note: The designation name is stamped on the top of the relay case as follows:
(Example) Designation ordered: FBR46D012-P
Stamp: 46D012-P

FBR46 SERIES

■ SAFETY STANDARD AND FILE NUMBERS

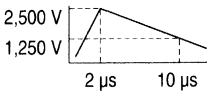
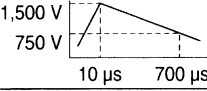
UL114 (File No. E63615)

C22.2 No. 14 (File No. LR40304 or LR64026)

| Nominal voltage | Contact rating |
|-----------------|---|
| 1.5 to 24 VDC | 1 A 30 VDC resistive 0.5 A 120 VAC resistive |

* Excluding latching type FBR46L

■ SPECIFICATIONS

| Item | | D type, G type | -15 type | -16 type | Latching | |
|-----------------------|--------------------------------------|--|---|------------------------|---|--------------------------|
| Contact | Arrangement and Style | 2 form C (DPDT), bifurcated | | | | |
| | Material | Gold-overlay silver-palladium | | | | |
| | Resistance (initial) | Maximum 100 mΩ (at 0.1 A 6 VDC) | | | | |
| | Ratings (resistive) | 0.5 A 120 VAC or 1 A 30 VDC | | | | |
| | Maximum Carrying Current | 1.25 A | | | | |
| | Maximum Switching Power | 60 VA or 30 W | | | | |
| | Max. Switching Voltage* ¹ | 125 V | | | | |
| | Maximum Switching Current | 1 A | | | | |
| | Minimum Switching load* ² | 0.01 mA 10 mVDC (reference) | | | | |
| | Electrostatic Capacity (reference) | Approximately 2 pF (between coil and contacts) Approximately 1 pF (between open contacts) | | | | |
| Coil | Nominal power (at 20°C) | 0.15 to 0.2 W 0.25 W | 0.2 to 0.25 W | 0.2 W | | |
| | Operate power (at 20°C) | 0.085 to 0.112 0.106 W maximum | 0.112 to 0.14 W maximum | 0.128 W maximum | | |
| | Operating Temperature | -30°C to +70°C (no frost) (refer to the CHARACTERISTIC DATA) | | | | |
| | Operating Humidity | 45 to 85%RH | | | | |
| Time Value | Operate (at nominal voltage) | Maximum 5 ms | | | | |
| | Release (at nominal voltage) | Maximum 2 ms | | | | |
| Insulation | Resistance (initial) | Minimum 1000 MΩ (at 500 VDC) | | | | |
| | Dielectric Strength (for 1 minute) | between coil and contacts between adjacent contacts | 1,000 VAC | 1,500 VAC | 1,000 VAC | |
| | | between open contacts | 750 VAC | 1,000 VAC | 750 VAC | |
| | | between set-reset-coil | — | | | 250 VAC |
| | Surge Strength | between coil and contacts between adjacent contacts | 1,500 V (at 10 x 700 μs) | 2,500 V (at 2 x 10 μs) |  | 1,500 V (at 10 x 700 μs) |
| between open contacts | | 1,500 V (at 10 x 700 μs) |  | | | |

Continued

FBR46 SERIES

| Item | | D type, G type | -15 type | -16 type | Latching |
|-------|--|----------------|--|----------|----------|
| Life | Mechanical | | 50 x 10 ⁶ operations minimum | | |
| | Electrical (refer to the REFERENCE DATA) | DC | 2 x 10 ⁵ operations minimum (at contact rating) | | |
| | | AC | 1 x 10 ⁵ operations minimum (at contact rating) | | |
| Other | Vibration Resistance | | 10 to 55 Hz (double amplitude of 1.5 mm) | | |
| | Shock Resistance | Misoperation | 500 m/s ² (11 ± ¹ ms) | | |
| | | Endurance | 1,000 m/s ² (11 ± ¹ ms) | | |
| | Weight | | Approximately 2.5 g | | |

*1 If the switching voltage exceeds the rated contact voltage, reduce the current. The current values vary according to the type of load.

*2 Values when switching a resistive load at normal room temperature and humidity and in a clean environment. The minimum switching load varies with the switching frequency and operation environment.

■ COIL DATA CHART

1. STANDARD (D type)

| MODEL | Nominal voltage | Coil resistance (±10%) | Nominal current (at nominal voltage) approx. | Must operate voltage*1 | Must release voltage*1 | Nominal power | Operate power | Coil temperature rise |
|--------------|-----------------|------------------------|--|-----------------------------|----------------------------|-------------------------------------|--------------------|-------------------------------------|
| FBR46ND003-P | 3 VDC | 60 Ω | 50 mA | 70% max. of nominal voltage | 5% min. of nominal voltage | Approx. 150 mW (at nominal voltage) | Approx. 85 mW max. | Approx. 25 deg (at nominal voltage) |
| FBR46ND005-P | 5 VDC | 167 Ω | 30 mA | | | | | |
| FBR46ND006-P | 6 VDC | 240 Ω | 25 mA | | | | | |
| FBR46ND009-P | 9 VDC | 540 Ω | 17 mA | | | | | |
| FBR46ND012-P | 12 VDC | 960 Ω | 13 mA | | | | | |
| FBR46ND024-P | 24 VDC | 2,880 Ω | 8 mA | | | 200 mW | 112 mW | 30 deg |

*1: Specified values are subject to pulse wave voltage.

Note: All values in the table are measured at 20°C

2. 65% OPERATE TYPE (G type)

| MODEL | Nominal voltage | Coil resistance (±10%) | Nominal current (at nominal voltage) approx. | Must operate voltage*1 | Must release voltage*1 | Nominal power | Operate power | Coil temperature rise |
|--------------|-----------------|------------------------|--|-----------------------------|-----------------------------|-------------------------------------|---------------------|-------------------------------------|
| FBR46NG003-P | 3 VDC | 36 Ω | 83 mA | 65% max. of nominal voltage | 10% min. of nominal voltage | Approx. 250 mW (at nominal voltage) | Approx. 106 mW max. | Approx. 35 deg (at nominal voltage) |
| FBR46NG005-P | 4.5 VDC | 81 Ω | 56 mA | | | | | |
| FBR46NG006-P | 6 VDC | 144 Ω | 41 mA | | | | | |
| FBR46NG009-P | 9 VDC | 324 Ω | 27 mA | | | | | |
| FBR46NG012-P | 12 VDC | 576 Ω | 20 mA | | | | | |
| FBR46NG024-P | 24 VDC | 2,304 Ω | 10 mA | | | | | |

*1: Specified values are subject to pulse wave voltage.

Note: All values in the table are measured at 20°C

FBR46 SERIES

3. HIGH DIELECTRIC STRENGTH TYPE (-15, -16 type)

| MODEL | | Nominal voltage | Coil resistance ($\pm 10\%$) | Nominal current (at nominal voltage) approx. | Must operate voltage*1 | Must release voltage*1 | Nominal power | Operate power | Coil temperature rise |
|-----------------|-----------------|-----------------|--------------------------------|--|-----------------------------|----------------------------|-------------------------------------|---------------------|-------------------------------------|
| -15 type | -16 type | | | | | | | | |
| FBR46ND003-P-15 | FBR46ND003-P-16 | 3 VDC | 45 Ω | 67 mA | 75% max. of nominal voltage | 5% min. of nominal voltage | Approx. 200 mW (at nominal voltage) | Approx. 112 mW max. | Approx. 30 deg (at nominal voltage) |
| FBR46ND005-P-15 | FBR46ND005-P-16 | 5 VDC | 125 Ω | 40 mA | | | | | |
| FBR46ND006-P-15 | FBR46ND006-P-16 | 6 VDC | 180 Ω | 33 mA | | | | | |
| FBR46ND009-P-15 | FBR46ND009-P-16 | 9 VDC | 405 Ω | 22 mA | | | | | |
| FBR46ND012-P-15 | FBR46ND012-P-16 | 12 VDC | 720 Ω | 17 mA | | | | | |
| FBR46ND024-P-15 | FBR46ND024-P-16 | 24 VDC | 2,304 Ω | 10 mA | | | 250 mW | 140 mW | 35 deg |

*1: Specified values are subject to pulse wave voltage.

Note: All values in the table are measured at 20°C.

4. LATCHING TYPE (L1, L2 type)

| MODEL | | Nominal voltage | Coil resistance ($\pm 10\%$) | Nominal current (at nominal voltage) approx. | Must operate voltage*1 | Must release voltage*1 | Nominal power | Operate power |
|------------------------------|------------------------------|-----------------|--------------------------------|--|-----------------------------|-----------------------------|-------------------------------------|---------------------|
| Single winding latching type | Double winding latching type | | | | | | | |
| FBR46NL103-P | FBR46NL203-P | 3 VDC | 45 Ω | 67 mA | 80% max. of nominal voltage | 80% max. of nominal voltage | Approx. 200 mW (at nominal voltage) | Approx. 128 mW max. |
| FBR46NL105-P | FBR46NL205-P | 5 VDC | 125 Ω | 40 mA | | | | |
| FBR46NL106-P | FBR46NL206-P | 6 VDC | 180 Ω | 33 mA | | | | |
| FBR46NL109-P | FBR46NL209-P | 9 VDC | 405 Ω | 22 mA | | | | |
| FBR46NL112-P | FBR46NL212-P | 12 VDC | 720 Ω | 17 mA | | | | |

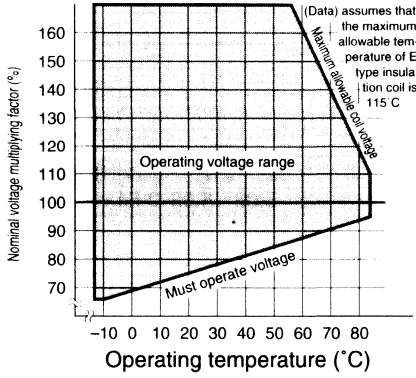
*1: Specified values are subject to pulse wave voltage.

Note: All values in the table are measured at 20°C.

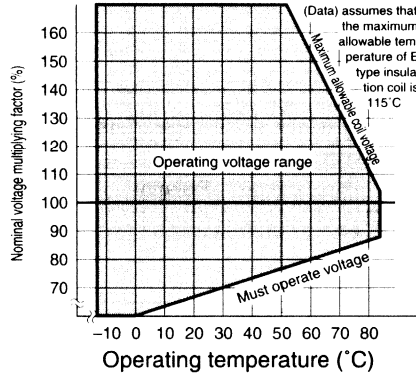
FBR46 SERIES

CHARACTERISTIC DATA

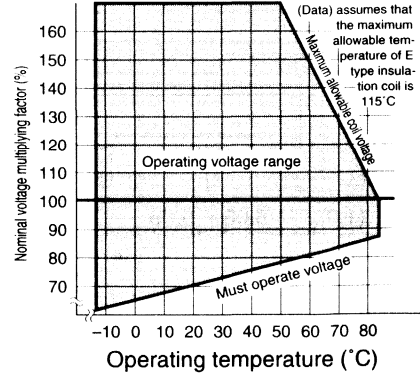
Range of operation temperature and voltage
[D type]



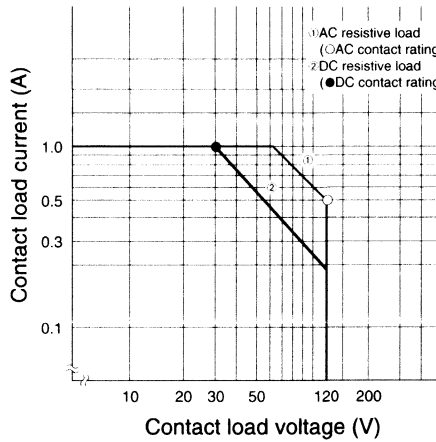
Range of operation temperature and voltage
[G type]



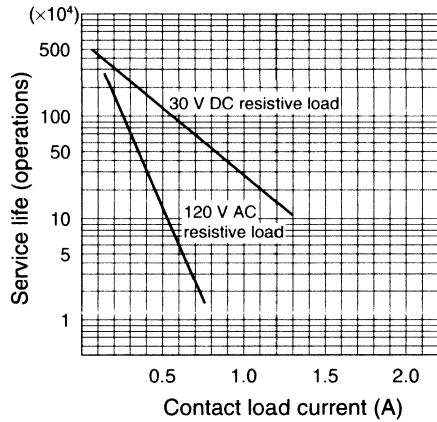
Range of operation temperature and voltage
[-15,-16 type]



Maximum switching capacity

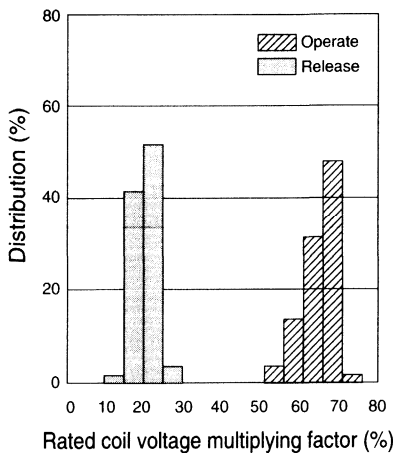


Life curve

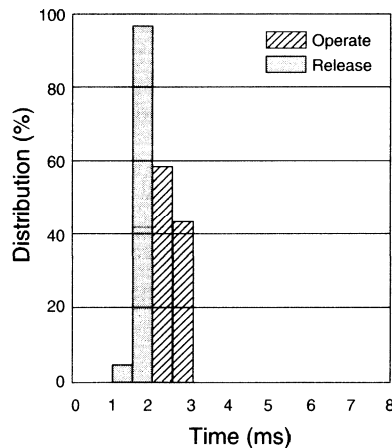


REFERENCE DATA

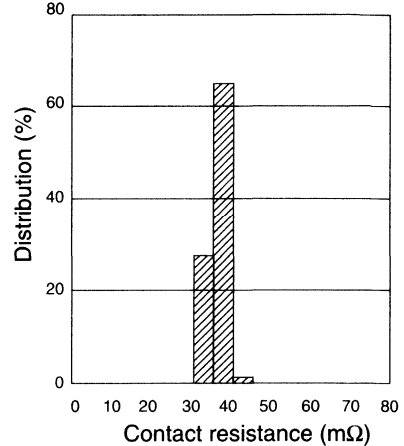
Distribution of operate and release voltage



Distribution of operate and release time



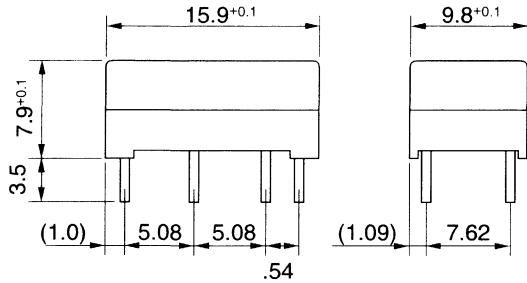
Distribution of contact resistance



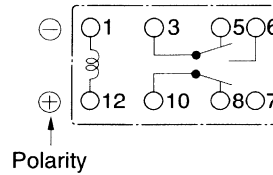
FBR46 SERIES

■ DIMENSIONS

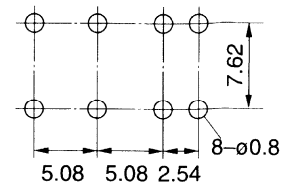
●Dimensions



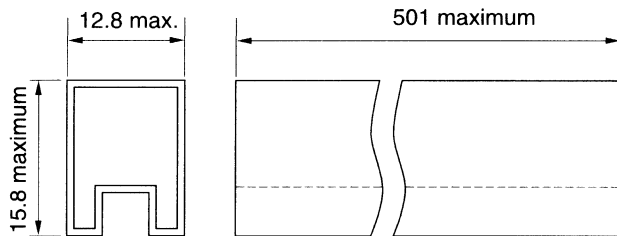
●Schematics (BOTTOM VIEW)



●PC board mounting hole layout (BOTTOM VIEW)

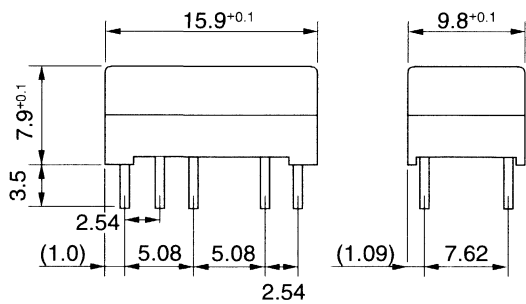


●Tube carrier

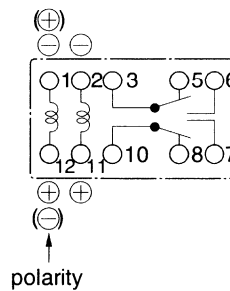


30 pieces/tube

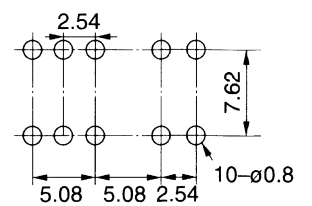
●Dimensions (Latching type)



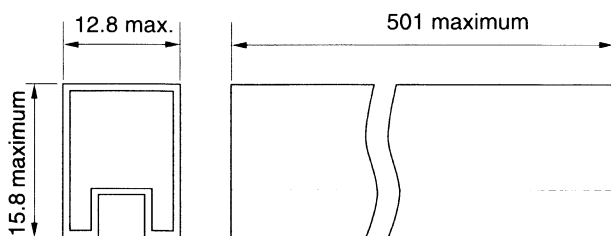
●Schematics (BOTTOM VIEW)



●PC board mounting hole layout (BOTTOM VIEW)



●Tube carrier



30 pieces/tube

Note: ·No 2, 11 terminals are for double winding latching type only.
 ·(⊕) (⊖) are reset polarity for single winding latching type.
 ·The terminal number is not shown on the relay.

Unit: mm

MINIATURE RELAY

2 POLES—1 to 2 A (FOR SIGNAL SWITCHING)

RA SERIES

■ FEATURES

- Ultra high sensitivity
- High reliability-bifurcated contacts
- Conforms to FCC rules and regulations Part 68
 - Dielectric strength 1,500 VAC between coil and contacts
 - Surge strength 1,500 V
- UL, CSA recognized
- Wide operating range
- DIL pitch terminals
- Plastic sealed type backfilled with nitrogen
- Latching type available
- Dial-pulse relay available



■ ORDERING INFORMATION

[Example] RA L - D 12 W - K
 (a) (b) (*) (c) (d) (e) (f)

| | | |
|-----|--------------------|--|
| (a) | Series Name | RA : RA Series |
| (b) | Operation Function | Nil : Standard type L : Latching type |
| (c) | Number of Coil | Nil : Single winding type D : Double winding type |
| (d) | Nominal Voltage | Refer to the COIL DATA CHART |
| (e) | Contact | W : Bifurcated type |
| (f) | Enclosure | K : Plastic sealed type |

Note: Actual marking omits the hyphen (-) of (*)
 For movable and stationary contact with gold overlay type, add suffix “-OH”.

■ SAFETY STANDARD AND FILE NUMBERS

UL478 (File No. E45026)

C22.2 No. 0, No. 14 (File No. LR35579)

Please request when the approval markings are required on the cover.

| Nominal voltage | Contact rating |
|-----------------|------------------|
| 1.5 to 48 VDC | 0.5 A 120 VAC |
| | 2 A 30 VDC |
| | 0.5 A 60 VDC |
| | — resistive |

RA SERIES

■ SPECIFICATIONS

| Item | | Standard Type | Single Winding Latching Type | Double Winding Latching Type |
|----------------|------------------------------|--|--|------------------------------|
| | | RA-() W-K | RAL-() W-K | RAL-D () W-K |
| Contact | Arrangement | 2 form C (DPDT) | | |
| | Material | Gold overlay silver alloy | | |
| | Style | Bifurcated | | |
| | Resistance (initial) | Maximum 100 mΩ (at 1 A 6 VDC) | | |
| | Rating (resistive) | 0.5 A 120 VAC or 1 A 24 VDC | | |
| | Maximum Carrying Current | 2 A | | |
| | Maximum Switching Power | 60 VA, 24 W | | |
| | Maximum Switching Voltage | 250 VAC, 220 VDC | | |
| | Maximum Switching Current | 2 A | | |
| | Minimum Switching Load*1 | 0.01 mA 10 mVDC | | |
| | Capacitance (10 MHz) | Approximately 1.5 pF (between open contacts), 1.0 pF (adjacent contacts) Approximately 1.7 pF (between coil and contacts) | | |
| Coil | Nominal Power (at 20°C) | 0.15 to 0.2 W | 0.075 to 0.2 W | 0.15 to 0.2 W |
| | Operate Power (at 20°C) | 0.07 to 0.09 W | 0.04 to 0.05 W | 0.07 to 0.09 W |
| | Operating Temperature | -40°C to +80°C (no frost) (refer to the CHARACTERISTIC DATA) | | |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | Maximum 6 ms (set) | |
| | Release (at nominal voltage) | Maximum 4 ms | Maximum 6 ms (reset) | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute | |
| | | between adjacent contacts | 1,500 VAC 1 minute | |
| | | between coil and contacts | 1,500 VAC 1 minute | |
| Surge Strength | 1,500 V | | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | |
| | Electrical | 200 x 10 ³ ops. min. (0.5 A 120 VAC), 500 x 10 ³ ops. min. (1 A 24 VDC) | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 5.0 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 5.0 mm) | |
| | Shock Resistance | Misoperation | 500 m/s ² (11 ±1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| | Weight | Approximately 3.7 g | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

RA SERIES

■ COIL DATA CHART

| | MODEL | Nominal voltage | Coil resistance (±10%) | Must operate voltage*1 | Must release voltage*1 | Nominal power |
|---------------|------------|-----------------|------------------------|------------------------|------------------------|---------------|
| Standard Type | RA-1.5 W-K | 1.5 VDC | 15 Ω | +1.0 VDC | +0.15 VDC | 150 mW |
| | RA- 3 W-K | 3 VDC | 60 Ω | +2.0 VDC | +0.3 VDC | 150 mW |
| | RA-4.5 W-K | 4.5 VDC | 135 Ω | +3.1 VDC | +0.45 VDC | 150 mW |
| | RA- 5 W-K | 5 VDC | 167 Ω | +3.4 VDC | +0.5 VDC | 150 mW |
| | RA- 6 W-K | 6 VDC | 240 Ω | +4.0 VDC | +0.6 VDC | 150 mW |
| | RA- 9 W-K | 9 VDC | 540 Ω | +6.1 VDC | +0.9 VDC | 150 mW |
| | RA-12 W-K | 12 VDC | 960 Ω | +8.1 VDC | +1.2 VDC | 150 mW |
| | RA-18 W-K | 18 VDC | 2,160 Ω | +12.3 VDC | +1.8 VDC | 150 mW |
| | RA-24 W-K | 24 VDC | 2,880 Ω | +16.1 VDC | +2.4 VDC | 200 mW |
| | RA-48 W-K | 48 VDC | 11,520 Ω | +32.2 VDC | +4.8 VDC | 200 mW |

Note: *1 Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

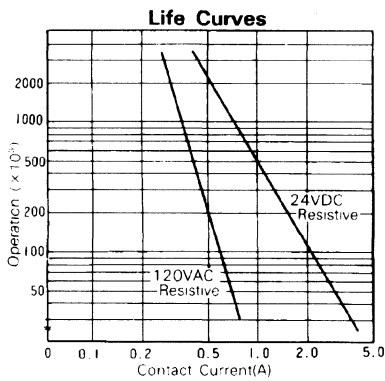
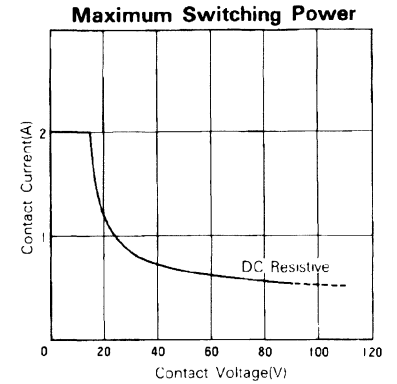
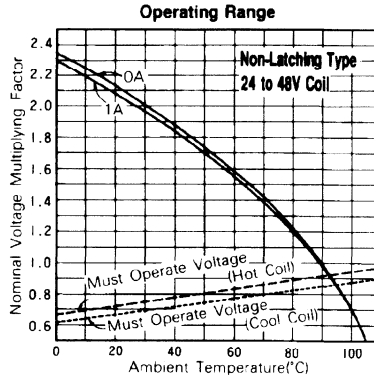
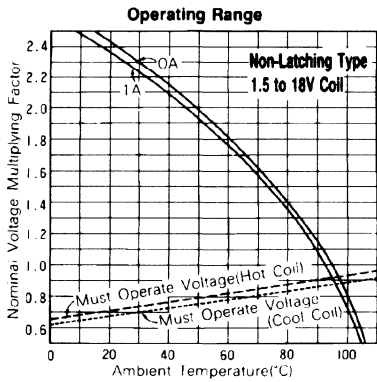
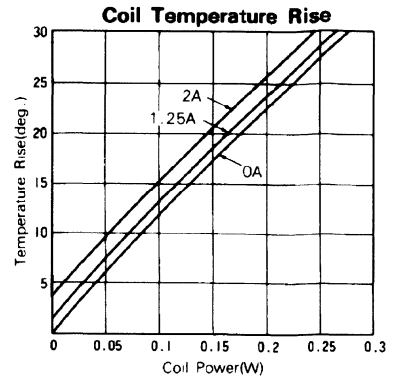
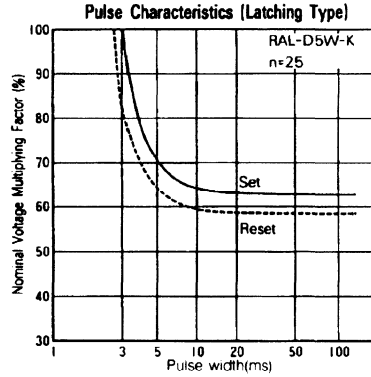
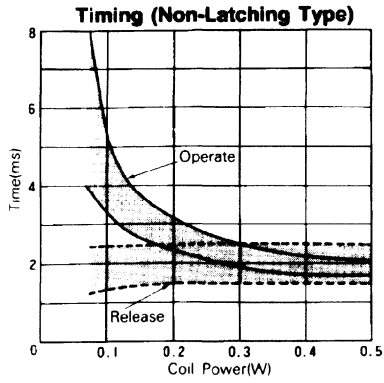
| | MODEL | Nominal voltage | Coil resistance (±10%) | Set voltage*1 | Reset voltage*1 | Nominal power |
|------------------------------|--------------|-----------------|------------------------|---------------|-----------------|---------------|
| Single Winding Latching Type | RAL-1.5 W-K | 1.5 VDC | 30 Ω | +1.0 VDC | -1.0 VDC | 75 mW |
| | RAL- 3 W-K | 3 VDC | 120 Ω | +2.1 VDC | -2.1 VDC | 75 mW |
| | RAL-4.5 W-K | 4.5 VDC | 270 Ω | +3.1 VDC | -3.1 VDC | 75 mW |
| | RAL- 5 W-K | 5 VDC | 335 Ω | +3.4 VDC | -3.4 VDC | 75 mW |
| | RAL- 6 W-K | 6 VDC | 480 Ω | +4.1 VDC | -4.1 VDC | 75 mW |
| | RAL- 9 W-K | 9 VDC | 1,080 Ω | +6.3 VDC | -6.3 VDC | 75 mW |
| | RAL-12 W-K | 12 VDC | 1,920 Ω | +8.3 VDC | -8.3 VDC | 75 mW |
| | RAL-18 W-K | 18 VDC | 4,320 Ω | +12.5 VDC | -12.5 VDC | 75 mW |
| | RAL-24 W-K | 24 VDC | 5,760 Ω | +16.6 VDC | -16.6 VDC | 100 mW |
| | | RAL-48 W-K | 48 VDC | 11,520 Ω | +21.0 VDC | -21.0 VDC |
| Double Winding Latching Type | RAL-D1.5 W-K | 1.5 VDC | P 15 Ω | +1.0 VDC | | 150 mW |
| | | | S 15 Ω | | +1.0 VDC | |
| | RAL-D 3 W-K | 3 VDC | P 60 Ω | +2.0 VDC | | 150 mW |
| | | | S 60 Ω | | +2.0 VDC | |
| | RAL-D4.5 W-K | 4.5 VDC | P 135 Ω | +3.1 VDC | | 150 mW |
| | | | S 135 Ω | | +3.1 VDC | |
| | RAL-D 5 W-K | 5 VDC | P 167 Ω | +3.4 VDC | | 150 mW |
| | | | S 167 Ω | | +3.4 VDC | |
| | RAL-D 6 W-K | 6 VDC | P 240 Ω | +4.0 VDC | | 150 mW |
| | | | S 240 Ω | | +4.0 VDC | |
| | RAL-D 9 W-K | 9 VDC | P 540 Ω | +6.1 VDC | | 150 mW |
| | | | S 540 Ω | | +6.1 VDC | |
| | RAL-D 12 W-K | 12 VDC | P 960 Ω | +8.1 VDC | | 150 mW |
| | | | S 960 Ω | | +8.1 VDC | |
| RAL-D 18 W-K | 18 VDC | P 2,160 Ω | +12.3 VDC | | 150 mW | |
| | | S 2,160 Ω | | +12.3 VDC | | |
| RAL-D 24 W-K | 24 VDC | P 2,880 Ω | +16.1 VDC | | 200 mW | |
| | | S 2,880 Ω | | +16.1 VDC | | |
| RAL-D 48 W-K | 48 VDC | P 11,520 Ω | +32.2 VDC | | 200 mW | |
| | | S 11,520 Ω | | +32.2 VDC | | |

Note: *1 Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

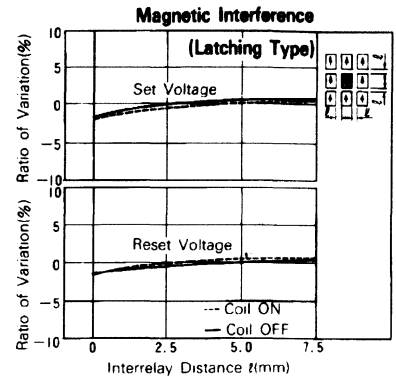
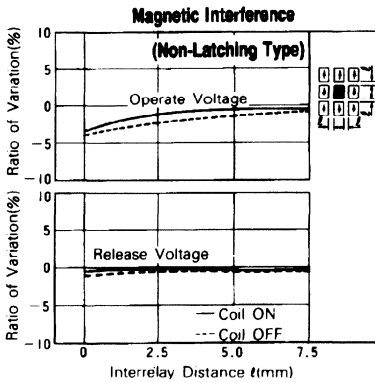
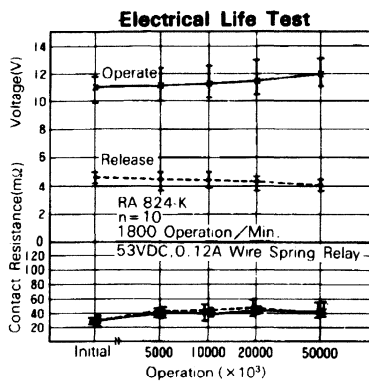
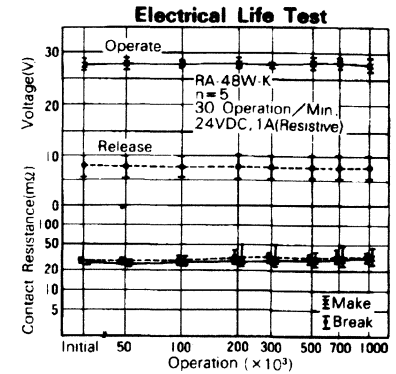
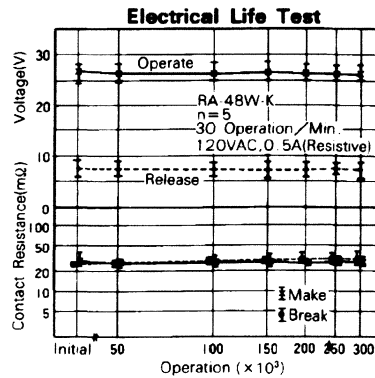
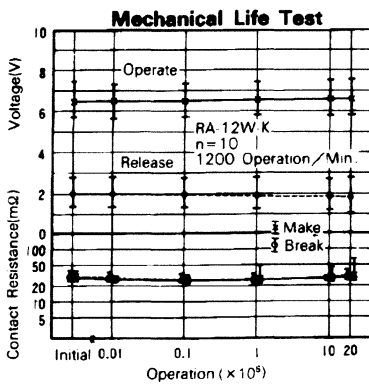
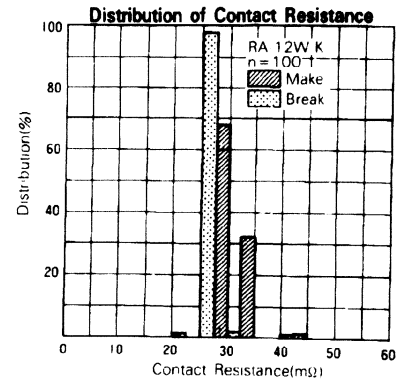
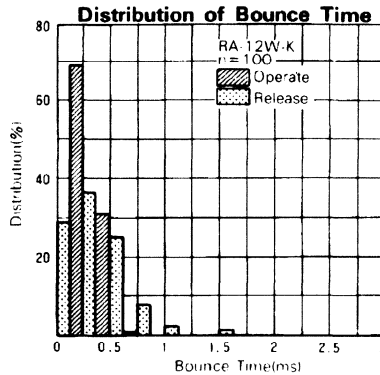
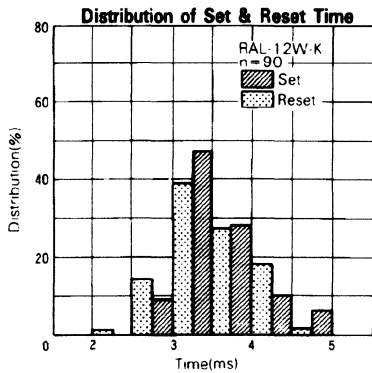
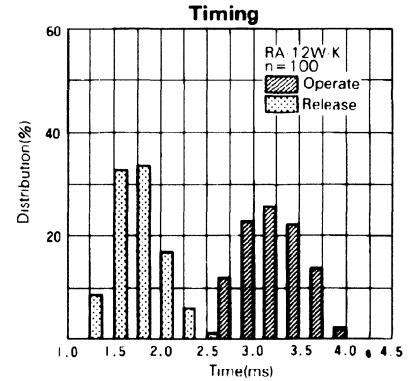
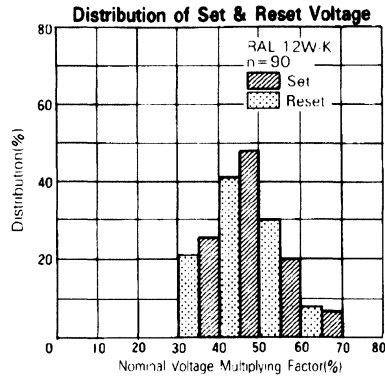
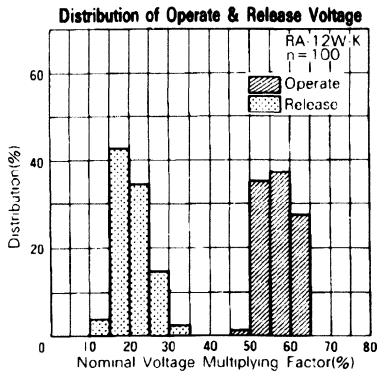
P: Primary coil S: Secondary coil

RA SERIES

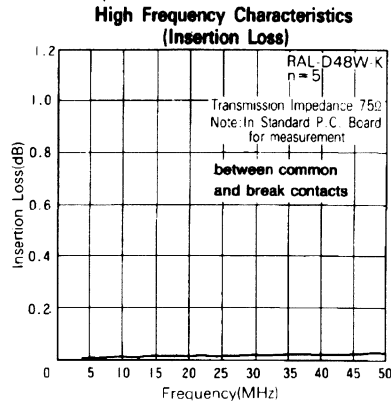
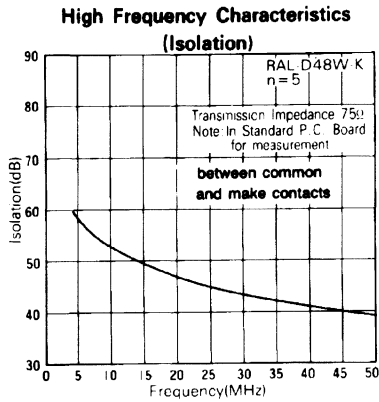
CHARACTERISTIC DATA



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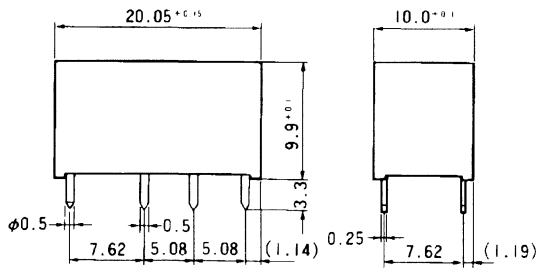
RA SERIES



■ DIMENSIONS

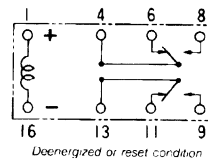
● Dimensions

RA, RAL type (Non-latching type, single winding latching type)



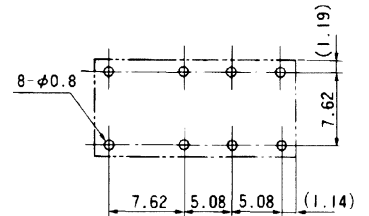
● Schematics

(Bottom View)

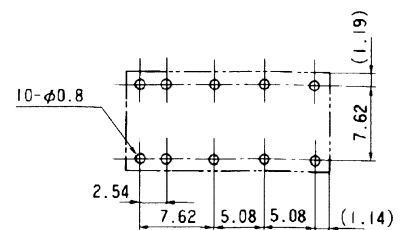
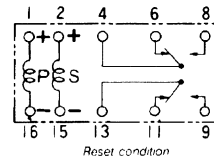
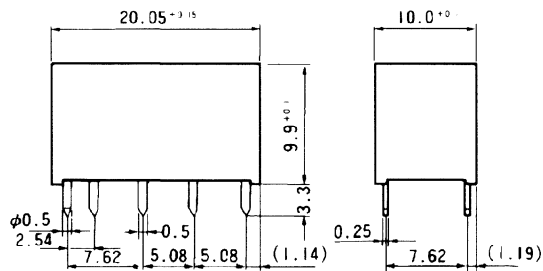


● PC board mounting hole layout

(Bottom View)



RAL-D type (Double winding latching type)



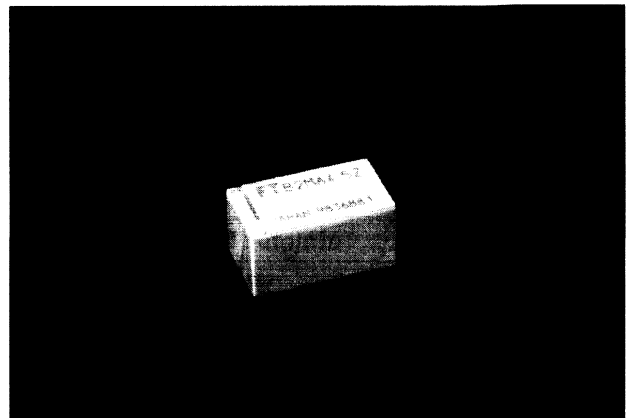
Unit: mm

4 POLE (2 FORM C+ 2 FORM A) SIGNAL RELAY FOR CENTRAL SWITCHING/DATA TRANSMISSION

FTR-B2 SERIES

■ FEATURES

- 4 POLE MINIATURE RELAY
Mounting space of 175mm² with 4 pole relay, suitable for high density mounting.
- HIGH RELIABILITY
Bifurcated gold overlay silver alloy contacts gives you high reliability.
- HIGH HEAT RESISTANCE, FLAMMABILITY
Flammability grade of 94V-0 materials employed
- Plastic sealed type gives you high resistance to various environments and allow you to clean the relay
- SMT VERSION
Surface mount type available on request



■ ORDERING INFORMATION

[Example] FTR-B2 M A 012 Z -**
 (a) (b) (c) (d) (e) (f)

| | | |
|-----|----------------------|--|
| (a) | Series Name | FTR-B2 |
| (b) | Contact Arrangement | M : 2 Form C + 2 Form A |
| (c) | Coil Type | A : Standard (400mW) |
| (d) | Coil Nominal Voltage | 4.5: 4.5VDC 012: 12VDC |
| (e) | Contact Material | Z : Gold overlay silver alloy |
| (f) | Custom Designation | Special Number for Customized Products |

Remarks: Actual marking on relay would not carry code FTR and be as below:

Ordering code Actual marking
FTR-B2MA012Z → B2MA012Z

Please contact with the nearest dealer for surface mount type.

FTR-B2 Series

■ COIL DATA CHART

| MODEL | Nominal Voltage | Coil Resistance | Operate Voltage | Release Voltage | Nominal Power |
|--------------|-----------------|-----------------|-----------------|-----------------|---------------|
| FTR-B2MA4.5Z | 4.5VDC | 50 Ω | 3.38VDC | 0.45VDC | 400mw |
| FTR-B2MA012Z | 12VDC | 355 Ω | 9.0VDC | 1.2VDC | 400mw |

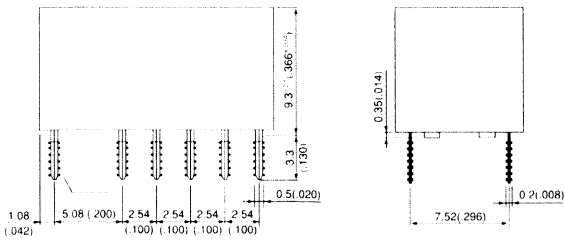
■ SPECIFICATIONS

| Item | FTR-B2 Series | |
|------------|--|--|
| Contact | Arrangement | 2 Form C + 2 Form A (N.O.) |
| | Material | Gold overlay Silver alloy |
| | Resistance (initial) | Maximum 75m Ω (1A 6V DC) |
| | Rating (resistive) | 30VDC 1A / 125VAC 0.2A |
| | Maximum Switching Power | 30W / 25VA |
| | Maximum Switching Voltage | 110VDC / 125VAC |
| | Maximum Switching Current | 1A |
| | Maximum Carrying Current | 1.25A |
| Time Value | Operate Time | Maximum 10ms (at nominal voltage) |
| | Release Time | Maximum 5ms (at nominal voltage) |
| Coil | Operating Temperature | -40° C ~ +85° C (no frost) |
| Insulation | Resistance (at 500VDC) | Minimum 1,000 M Ω |
| | Dielectric Strength, Surge Strength 2500V 2 x 10 μ s between coil-cont. | 700 VAC 1 Min. (Open Contacts) 500 VAC 1 Min. (Adjacent Contacts) 1,500 VAC 1 Min. (Coil-Contacts) |
| Life | Mechanical | 10 x 10 ⁶ operations minimum |
| | Electrical | 50 x 10 ³ operations minimum @ 30VDC 1A 100 x 10 ³ operations minimum @ 125VDC 0.2A |
| Vibration | Misoperation | 10-55 Hz (double amplitude of 1.5mm) |
| | Endurance | 10-55 Hz (double amplitude of 1.5mm) |
| Shock | Misoperation | 100m/s ² (11 \pm 1ms) |
| | Endurance | 500m/s ² (6 \pm 1ms) |
| Weight | | Approximately 3.9g |

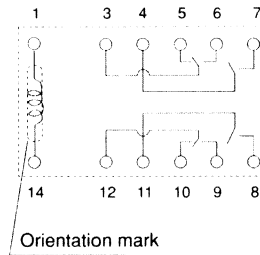
FTR-B2 SERIES

■ DIMENSIONS

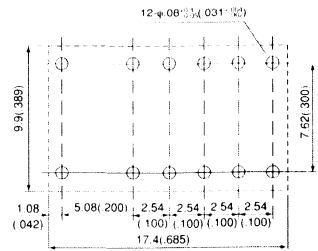
● Dimensions



● Schematics (BOTTOM VIEW)

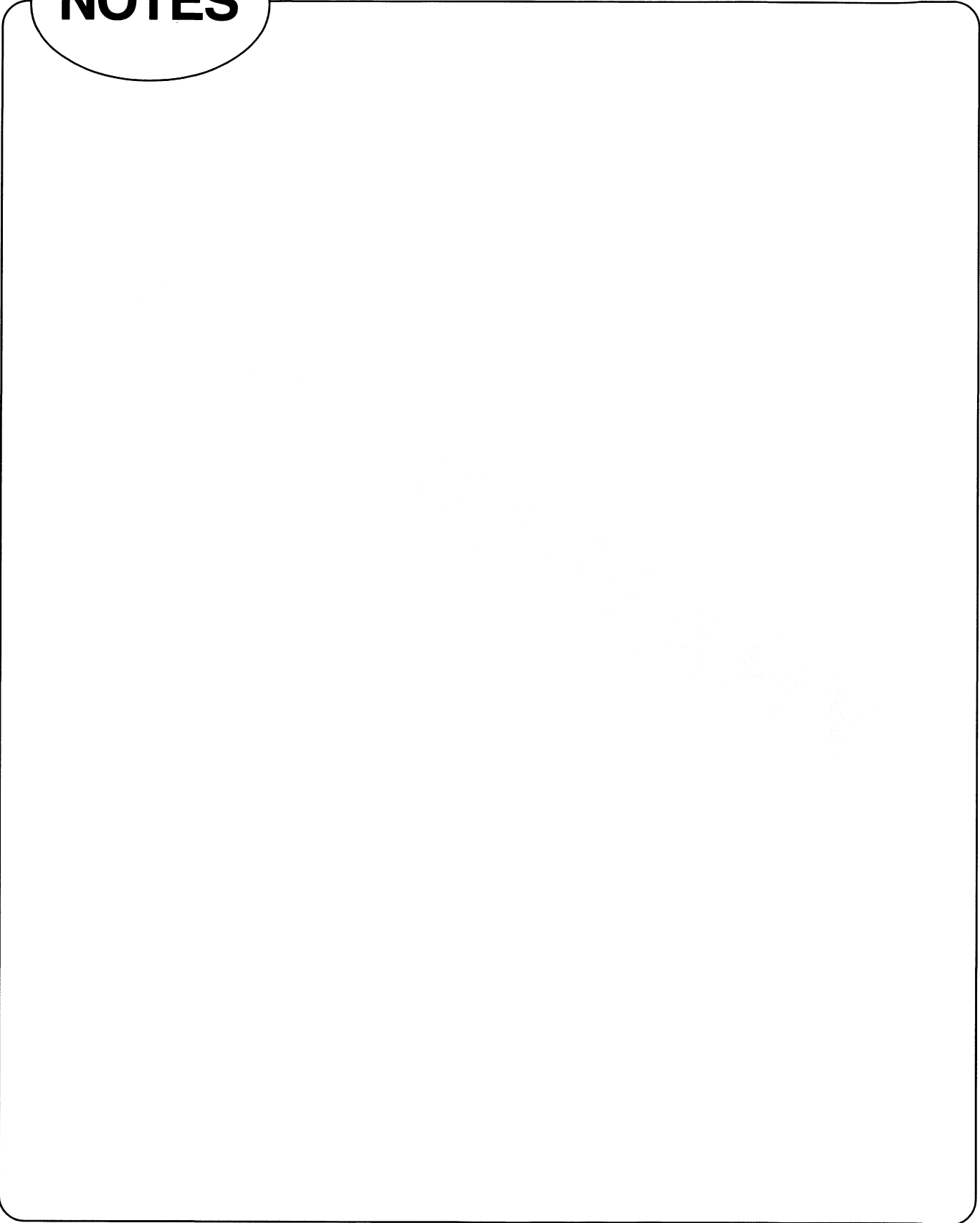


● PC board mounting hole layout (BOTTOM VIEW)



FTR-B2 Series

NOTES



MINIATURE RELAY

4 POLES—1 to 2 A (FOR SIGNAL SWITCHING)

RA4 SERIES

■ FEATURES

- Ultra high sensitivity
- High reliability-bifurcated contacts
- Conforms to FCC rules and regulations Part 68
 - Dielectric strength 1,500 VAC between coil and contacts
 - Surge strength 1,500 V
- UL, CSA recognized
- Wide operating range
- DIL pitch terminals
- Plastic sealed type backfilled with nitrogen
- Latching type available



■ ORDERING INFORMATION

[Example] RA4 L - D 12 W - K
 (a) (b) (c) (d) (e) (f)

| | | |
|-----|--------------------|--|
| (a) | Series Name | RA4 : RA4 Series |
| (b) | Operation Function | Nil : Standard type L : Latching type |
| (c) | Number of Coil | Nil : Single winding type D : Double winding type |
| (d) | Nominal Voltage | Refer to the COIL DATA CHART |
| (e) | Contact | W : Bifurcated type |
| (f) | Enclosure | K : Plastic sealed type |

Note: For movable and stationary contact with gold overlay type, add suffix ""-OH"".

■ SAFETY STANDARD AND FILE NUMBERS

UL478 (File No. E45026)

C22.2 No. 0, No. 14 (File No. LR35579)

Please request when the approval markings are required on the cover.

| Nominal voltage | Contact rating |
|-----------------|------------------|
| 1.5 to 48 VDC | 0.5 A 120 VAC |
| | 2 A 30 VDC |
| | 0.5 A 60 VDC |
| | resistive |

RA4 SERIES

■ SPECIFICATIONS

| Item | | Standard Type | Single Winding Latching Type | Double Winding Latching Type |
|----------------|--------------------------------------|--|--|------------------------------|
| | | RA4-() W-K | RA4L-() W-K | RA4L-D () W-K |
| Contact | Arrangement | 4 form C (4DPDT) | | |
| | Material | Gold overlay silver alloy | | |
| | Style | Bifurcated | | |
| | Resistance (initial) | Maximum 100 mΩ (at 1 A 6 VDC) | | |
| | Rating (resistive) | 0.5 A 120 VAC or 1 A 24 VDC | | |
| | Maximum Carrying Current | 2 A | | |
| | Maximum Switching Power | 60 VA, 24 W | | |
| | Maximum Switching Voltage | 250 VAC, 220 VDC | | |
| | Maximum Switching Current | 2 A | | |
| | Minimum Switching Load* ¹ | 0.01 mA 10 mVDC | | |
| | Capacitance (10 MHz) | Approximately 1.4 pF (between open contacts), 1.3 pF (adjacent contacts) Approximately 2.4 pF (between coil and contacts) | | |
| Coil | Nominal Power (at 20°C) | 0.2 W | 0.09 W | 0.18 W |
| | Operate Power (at 20°C) | 0.1 W | 0.045 W | 0.09 W |
| | Operating Temperature | -40°C to +80°C (no frost) (refer to the CHARACTERISTIC DATA) | | |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | Maximum 6 ms (set) | |
| | Release (at nominal voltage) | Maximum 4 ms | Maximum 6 ms (reset) | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute | |
| | | between adjacent contacts | 1,500 VAC 1 minute | |
| | | between coil and contacts | 1,500 VAC 1 minute | |
| Surge Strength | 1,500 V | | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | |
| | Electrical | 200 x 10 ³ ops. min. (0.5 A 120 VAC), 500 x 10 ³ ops. min. (1 A 24 VDC) | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 3.3 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 5.0 mm) | |
| | Shock Resistance | Misoperation | 300 m/s ² (11 ±1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| | Weight | Approximately 6.4 g | | |

*¹ Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

RA4 SERIES

■ COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance (±10%) | Must operate voltage* ¹ | Must release voltage* ¹ | Nominal power |
|---------------|-------------|-----------------|------------------------|------------------------------------|------------------------------------|---------------|
| Standard Type | RA4-1.5 W-K | 1.5 VDC | 11Ω | +1.0 VDC | +0.15 VDC | 200 mW |
| | RA4- 3 W-K | 3 VDC | 45Ω | +2.1 VDC | +0.3 VDC | 200 mW |
| | RA4-4.5 W-K | 4.5 VDC | 100Ω | +3.1 VDC | +0.45 VDC | 200 mW |
| | RA4- 5 W-K | 5 VDC | 125Ω | +3.5 VDC | +0.5 VDC | 200 mW |
| | RA4- 6 W-K | 6 VDC | 180Ω | +4.2 VDC | +0.6 VDC | 200 mW |
| | RA4- 9 W-K | 9 VDC | 405Ω | +6.3 VDC | +0.9 VDC | 200 mW |
| | RA4- 12 W-K | 12 VDC | 720Ω | +8.4 VDC | +1.2 VDC | 200 mW |
| | RA4- 18 W-K | 18 VDC | 1,620Ω | +12.6 VDC | +1.8 VDC | 200 mW |
| | RA4- 24 W-K | 24 VDC | 2,880Ω | +16.8 VDC | +2.4 VDC | 200 mW |
| | RA4- 48 W-K | 48 VDC | 11,520Ω | +33.6 VDC | +4.8 VDC | 200 mW |

Note: *¹ Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

RA4 SERIES

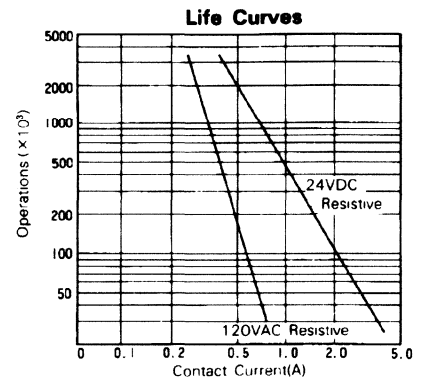
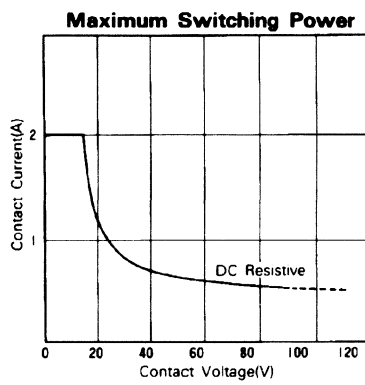
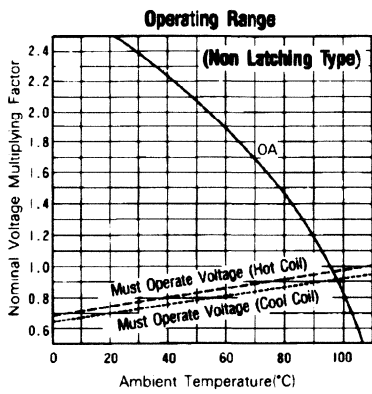
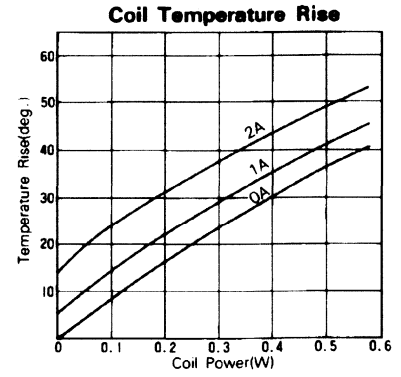
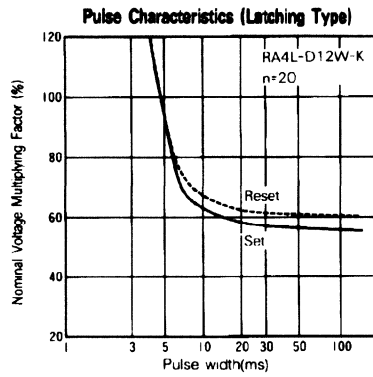
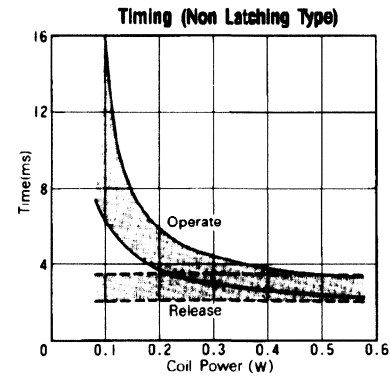
| MODEL | | Nominal voltage | Coil resistance (±10%) | Set voltage* ¹ | Reset voltage* ¹ | Nominal power |
|------------------------------|---------------|-----------------|------------------------|---------------------------|-----------------------------|---------------|
| Single Winding Latching Type | RA4L-1.5 W-K | 1.5 VDC | 25Ω | +1.0 VDC | -1.0 VDC | 90 mW |
| | RA4L- 3 W-K | 3 VDC | 100Ω | +2.1 VDC | -2.1 VDC | 90 mW |
| | RA4L-4.5 W-K | 4.5 VDC | 225Ω | +3.1 VDC | -3.1 VDC | 90 mW |
| | RA4L- 5 W-K | 5 VDC | 278Ω | +3.5 VDC | -3.5 VDC | 90 mW |
| | RA4L- 6 W-K | 6 VDC | 400Ω | +4.2 VDC | -4.2 VDC | 90 mW |
| | RA4L- 9 W-K | 9 VDC | 900Ω | +6.3 VDC | -6.3 VDC | 90 mW |
| | RA4L- 12 W-K | 12 VDC | 1,600Ω | +8.4 VDC | -8.4 VDC | 90 mW |
| | RA4L- 18 W-K | 18 VDC | 3,600Ω | +12.6 VDC | -12.6 VDC | 90 mW |
| | RA4L- 24 W-K | 24 VDC | 6,400Ω | +16.8 VDC | -16.8 VDC | 90 mW |
| RA4L- 48 W-K | 48 VDC | 25,600Ω | +33.6 VDC | -33.6 VDC | 90 mW | |
| Double Winding Latching Type | RA4L-D1.5 W-K | 1.5 VDC | P 12.5Ω | +1.0 VDC | | 180 mW |
| | | | S 12.5Ω | | | |
| | RA4L-D 3 W-K | 3 VDC | P 50Ω | +2.1 VDC | | 180 mW |
| | | | S 50Ω | | | |
| | RA4L-D4.5 W-K | 4.5 VDC | P 113Ω | +3.1 VDC | | 180 mW |
| | | | S 113Ω | | | |
| | RA4L-D 5 W-K | 5 VDC | P 139Ω | +3.5 VDC | | 180 mW |
| | | | S 139Ω | | | |
| | RA4L-D 6 W-K | 6 VDC | P 200Ω | +4.2 VDC | | 180 mW |
| | | | S 200Ω | | | |
| | RA4L-D 9 W-K | 9 VDC | P 450Ω | +6.3 VDC | | 180 mW |
| | | | S 450Ω | | | |
| | RA4L-D 12 W-K | 12 VDC | P 800Ω | +8.4 VDC | | 180 mW |
| | | | S 800Ω | | | |
| | RA4L-D 18 W-K | 18 VDC | P 1,800Ω | +12.6 VDC | | 180 mW |
| | | | S 1,800Ω | | | |
| | RA4L-D 24 W-K | 24 VDC | P 3,200Ω | +16.8 VDC | | 180 mW |
| | | | S 3,200Ω | | | |
| RA4L-D 48 W-K | 48 VDC | P 12,800Ω | +33.6 VDC | | 180 mW | |
| | | S 12,800Ω | | | | +33.6 VDC |

Note: *¹ Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

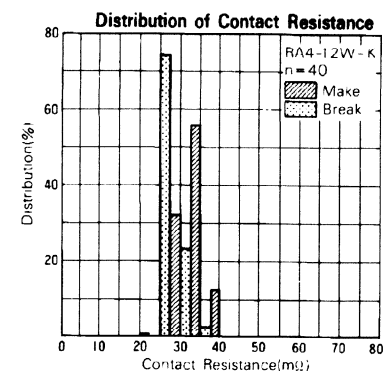
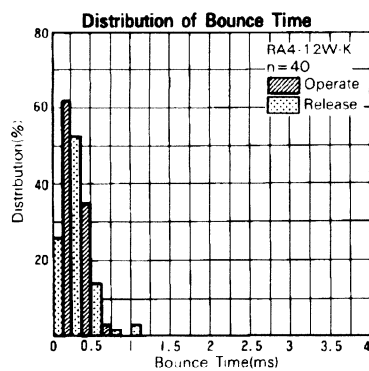
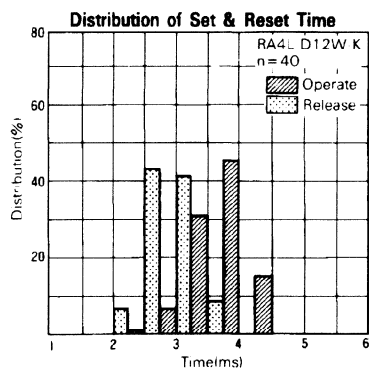
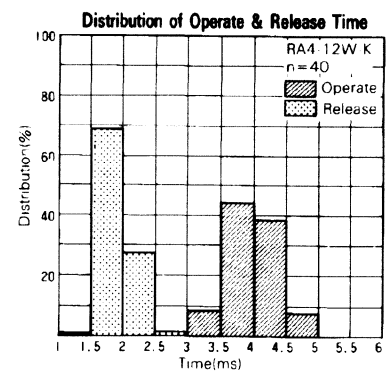
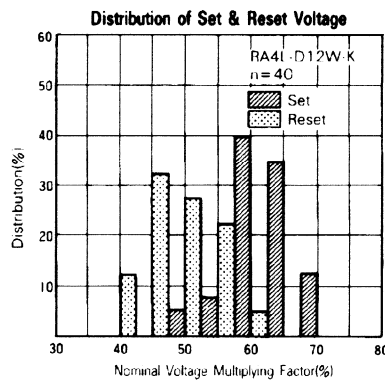
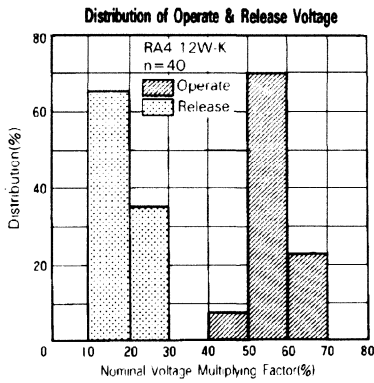
P: Primary coil S: Secondary coil

RA4 SERIES

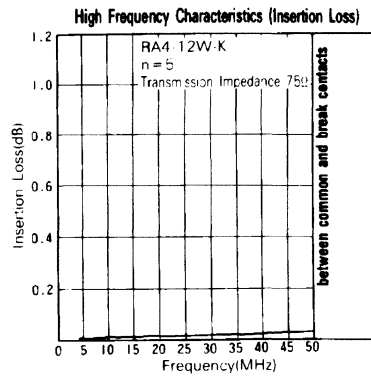
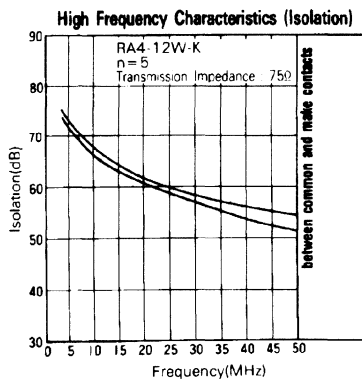
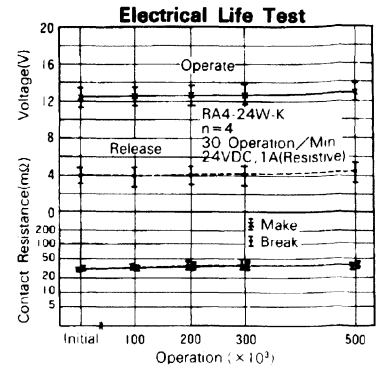
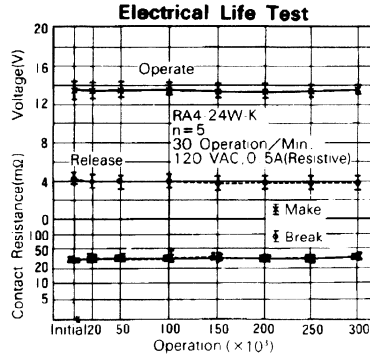
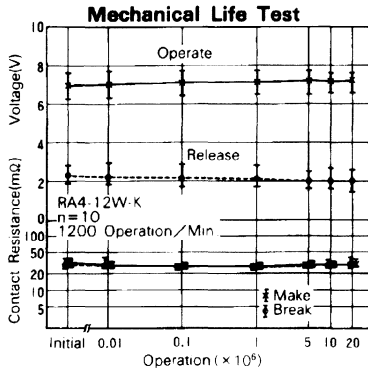
CHARACTERISTIC DATA



REFERENCE DATA



RA4 SERIES



■ DIMENSIONS

● Dimensions

● Schematics

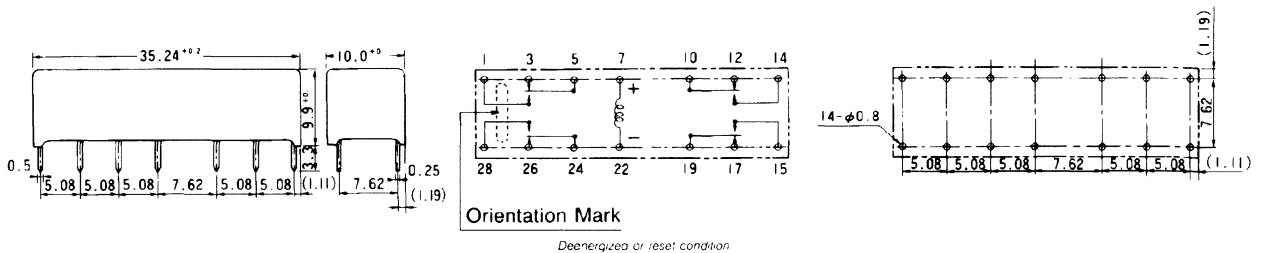
(Bottom View)

● PC board mounting

hole layout

(Bottom view)

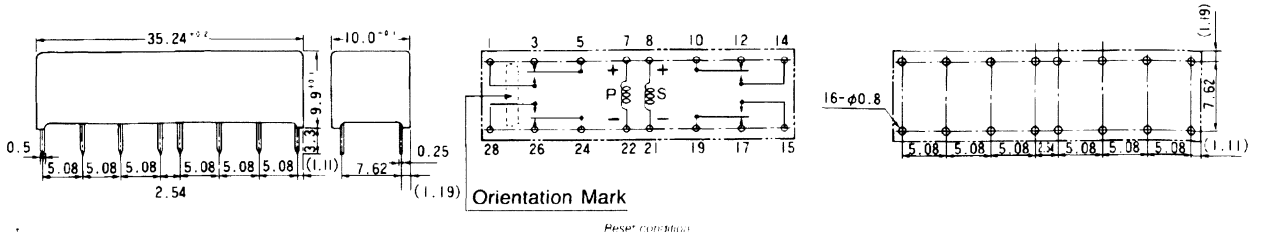
RA4, RA4L type (Non-latching type, single winding latching type)



Orientation Mark

Deenergized or reset condition

RA4L-D type (Double winding latching type)



Orientation Mark

Reset condition

Unit: mm

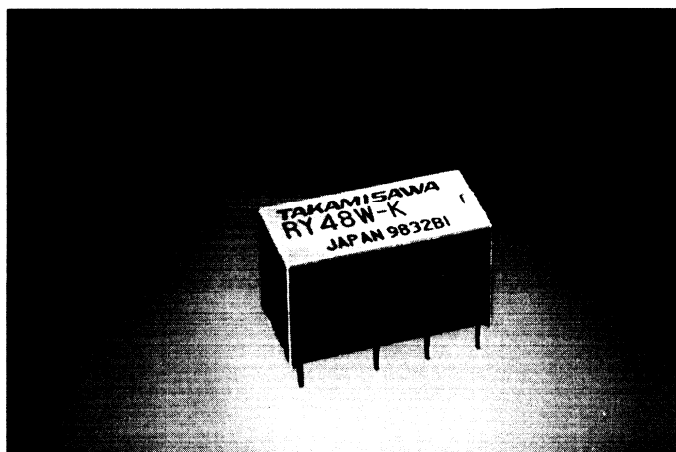
MINIATURE RELAY

2 POLES—1 to 2 A (FOR SIGNAL SWITCHING)

RY SERIES

■ FEATURES

- Ultra high sensitivity
- UL, CSA recognized
- Conforms to FCC rules and regulations Part 68
—Surge strength 1,500 V
- High dielectric strength type available (RY-WF type)
- Contact arrangement MBB type available (RY-D type)
- High reliability-bifurcated contacts
- Wide operating range
- DIL pitch terminals
- Plastic sealed type backfilled with nitrogen



■ ORDERING INFORMATION

[Example] $\frac{RY}{(a)}$ - $\frac{12}{(*)}$ $\frac{WF}{(b)}$ - $\frac{K}{(c)}$

| | | |
|-----|---------------------------|---|
| (a) | Series Name | RY : RY Series |
| (b) | Nominal Voltage | Refer to the COIL DATA CHART |
| (c) | Coil and Contact Function | W : High sensitive type WZ : Nominal 0.5 W type WF : High dielectric strength type WFZ : 2 A type D : 2 FORM D (2 MBB type) |
| (d) | Enclosure | K : Plastic sealed type |

Note: Actual marking omits the hyphen (-) of (*)

For movable and stationary contact with gold overlay type, add suffix “-OH”.

RY SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL478 (File No. E45026)

C22.2 No. 14 (File No. LR35579)

Please request when the approval markings are required on the cover.

Please note that UL/CSA ratings may differ from the standard ratings.

| Type | Nominal voltage | Contact rating* ¹ | | |
|---------------|-----------------|------------------------------|------------------------------|-----------|
| RY-W RY-WZ | 3 to 48 VDC | 0.5 A 1 A 0.3 A | 120 VAC 24 VDC 60 VDC | resistive |
| RY-WF | 5 to 48 VDC | 0.25 A 1 A 0.3 A | 120 VAC 48 VDC 60 VDC | resistive |
| RY-WFZ | 3 to 48 VDC | 0.5 A 2 A 0.6 A | 120 VAC 30 VDC 110 VDC | resistive |
| RY-D | 4.5 to 48 VDC | 0.3 A 0.2 A | 120 VAC 60 VDC | resistive |

Note: *¹ Contact ratings mentioned above are subject to same polarity.

RY SERIES

■ SPECIFICATIONS

| Item | | High Sensitive Type | 500 mW Type | High Dielectric Strength | 2 A Type | Continuous (MBB) Type | |
|----------------|--------------------------------------|---|---|--|---|--|--|
| | | RY-() W-K | RY-() WZ-K | RY-() WF-K | RY-() WFZ-K | RY-() D-K | |
| Contact | Arrangement | 2 form C (DPDT) | | | | 2 Form D (2 MBB) | |
| | Material | Gold overlay silver-palladium | | | Gold overlay silver-nickel | Gold overlay silver-palladium | |
| | Style | Bifurcated | | | | Single | |
| | Resistance (initial) | Maximum 100 mΩ (at 1 A 6 VDC) | | | | | |
| | Maximum Carrying Current | 1.25 A | | | 2 A | 0.6 A | |
| | Rating | 1 A 24 VD 0.5 A 120 VAC | | 1 A 24 VDC 0.25 A 120 VAC | 2 A 30 VDC 0.5 A 125 VAC | 0.15 A 48 VDC 0.3 A 120 VAC | |
| | Maximum Switching Power | 60 VA/24 W | | 30 VA/24 W | 62.5 VA/60 W | 36 VA/7.2 W | |
| | Maximum Switching Voltage | 120 VAC, 60 VDC | | | 125 VAC, 150 VDC | 120 VAC, 60 VDC | |
| | Maximum Switching Current | 1 A | | | 2 A | 0.6 A | |
| | Minimum Switching Load* ¹ | 0.01 mA 10 mVDC | | | | 0.1 mA 10 mVDC | |
| | Capacitance | Approx. 0.9 pF (between open contacts) 1.4 pF (adjacent contacts) Approx. 1.9 pF (between coil and contacts) | | | | | |
| Coil | Nominal Power (at 20°C) | 0.15 to 0.3 W | 0.5 to 0.58 W | 0.45 to 0.46 W | 0.5 to 0.58 W | 0.45 to 0.48 W | |
| | Operate Power (at 20°C) | 0.075 to 0.14 W | 0.125 to 0.145 W | 0.2 to 0.21 W | 0.2 to 0.324 W | 0.2 to 0.21 W | |
| | Operating Temperature (No frost) | -30°C to +90°C | -30°C to +60°C (refer to the CHARACTERISTIC DATA) | | | -30°C to +70°C | |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | | | | | |
| | Release (at nominal voltage) | Maximum 3 ms | | | | | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | | | | |
| | Dielectric Strength | between open contacts | AC 500 V 1 minute | 1,000 VAC 1 minute | 500 VAC 1 minute | | |
| | | between adjacent contacts | 1,000 VAC 1 minute | | | | |
| | | between coil and contacts | 1,000 VAC 1 minute | | | | |
| Surge Strength | 1,500 V | | | | | | |
| Life | Mechanical | 20 x 10 ⁶ ops. min. | 10 x 10 ⁶ operations minimum | | | 1 x 10 ⁶ ops. min. | |
| | Electrical (at contact rating) | 200 x 10 ³ ops. min. (0.5 A 120 VAC) 500 x 10 ³ ops. min. (1 A 24 VD C) | | 500 x 10 ³ ops. min. (0.25 A 120 VAC 1 A 24 VDC | 100 x 10 ³ ops. min. (2 A 30 VDC) | 200 x 10 ³ ops. min. (0.3 A 120 VAC) 500 x 10 ³ ops. min. (0.15 A 48 VDC) | |
| Other | Vibration | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) | | | | |
| | Resistance | Endurance | 10 to 55 Hz (double amplitude of 4.5 mm) | | | | |
| | Shock | Misoperation | 100 m/s ² (11±1 ms) | | | | |
| | Resistance | Endurance | 1,000 m/s ² (6±1 ms) | | | | |
| | Weight | Approximately 5 g | | | | | |

*¹ Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

RY SERIES

■ COIL DATA CHART

| | MODEL | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage | Nominal power |
|--------------------------|--------------|-----------------|------------------------|----------------------|----------------------|---------------|
| High Sensitive Type | RY-4.5 W-K | 4.5 VDC | 135Ω | 3.2 VDC | 0.23 VDC | 150 mW |
| | RY- 5 W-K | 5 VDC | 165Ω | 3.6 VDC | 0.25 VDC | 150 mW |
| | RY- 6 W-K | 6 VDC | 240Ω | 4.3 VDC | 0.3 VDC | 150 mW |
| | RY- 9 W-K | 9 VDC | 540Ω | 6.4 VDC | 0.45 VDC | 150 mW |
| | RY- 12 W-K | 12 VDC | 960Ω | 8.5 VDC | 0.6 VDC | 150 mW |
| | RY- 18 W-K | 18 VDC | 1,620Ω | 12.6 VDC | 0.9 VDC | 200 mW |
| | RY- 24 W-K | 24 VDC | 2,880Ω | 16.8 VDC | 1.2 VDC | 200 mW |
| | RY- 48 W-K | 48 VDC | 7,680Ω | 32.6 VDC | 2.4 VDC | 300 mW |
| 500 mW Type | RY- 3 WZ-K | 3 VDC | 18Ω | 1.5 VDC | 0.15 VDC | 500 mW |
| | RY-4.5 WZ-K | 4.5 VDC | 36Ω | 2.25 VDC | 0.23 VDC | 560 mW |
| | RY- 5 WZ-K | 5 VDC | 45Ω | 2.5 VDC | 0.25 VDC | 560 mW |
| | RY- 6 WZ-K | 6 VDC | 66Ω | 3.0 VDC | 0.3 VDC | 550 mW |
| | RY- 9 WZ-K | 9 VDC | 140Ω | 4.5 VDC | 0.45 VDC | 580 mW |
| | RY- 12 WZ-K | 12 VDC | 280Ω | 6.0 VDC | 0.6 VDC | 510 mW |
| | RY- 18 WZ-K | 18 VDC | 560Ω | 9.0 VDC | 0.9 VDC | 580 mW |
| | RY- 24 WZ-K | 24 VDC | 1,070Ω | 12.0 VDC | 1.2 VDC | 540 mW |
| | RY- 48 WZ-K | 48 VDC | 4,000Ω | 24.0 VDC | 2.4 VDC | 580 mW |
| High Dielectric Strength | RY- 5 WF-K | 5 VDC | 56Ω | 3.3 VDC | 0.25 VDC | 450 mW |
| | RY- 6 WF-K | 6 VDC | 80Ω | 4.0 VDC | 0.3 VDC | 450 mW |
| | RY- 9 WF-K | 9 VDC | 180Ω | 6.0 VDC | 0.45 VDC | 450 mW |
| | RY- 12 WF-K | 12 VDC | 320Ω | 8.0 VDC | 0.6 VDC | 450 mW |
| | RY- 18 WF-K | 18 VDC | 720Ω | 12.0 VDC | 0.9 VDC | 450 mW |
| | RY- 24 WF-K | 24 VDC | 1,260Ω | 15.9 VDC | 1.2 VDC | 450 mW |
| | RY- 48 WF-K | 48 VDC | 5,000Ω | 33.0 VDC | 2.4 VDC | 460 mW |
| 2 A Type | RY- 3 WFZ-K | 3 VDC | 18Ω | 1.9 VDC | 0.15 VDC | 500 mW |
| | RY-4.5 WFZ-K | 4.5 VDC | 36Ω | 2.9 VDC | 0.23 VDC | 560 mW |
| | RY- 5 WFZ-K | 5 VDC | 45Ω | 3.2 VDC | 0.25 VDC | 560 mW |
| | RY- 6 WFZ-K | 6 VDC | 66Ω | 3.8 VDC | 0.3 VDC | 550 mW |
| | RY- 9 WFZ-K | 9 VDC | 140Ω | 5.7 VDC | 0.45 VDC | 580 mW |
| | RY- 12 WFZ-K | 12 VDC | 280Ω | 7.6 VDC | 0.6 VDC | 510 mW |
| | RY- 18 WFZ-K | 18 VDC | 560Ω | 11.4 VDC | 0.9 VDC | 580 mW |
| | RY- 24 WFZ-K | 24 VDC | 1,070Ω | 15.2 VDC | 1.2 VDC | 540 mW |
| | RY -48 WFZ-K | 48 VDC | 4,000Ω | 36.0 VDC | 2.4 VDC | 580 mW |

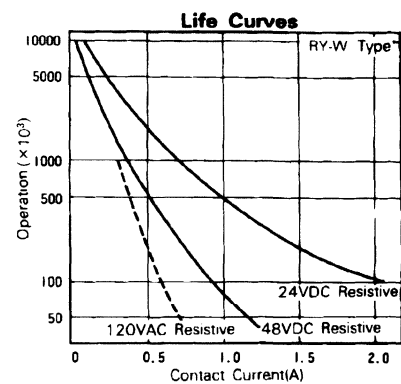
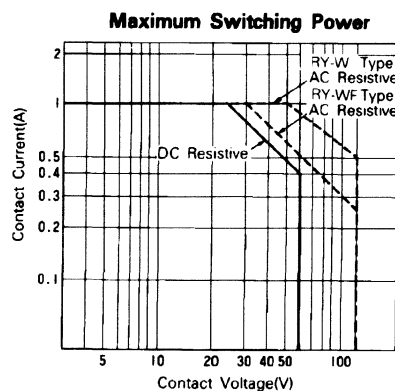
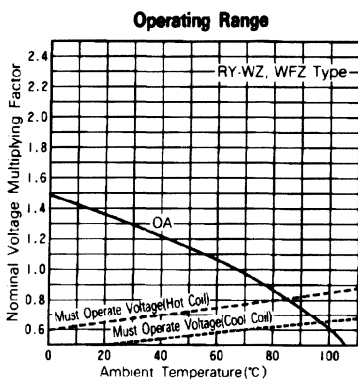
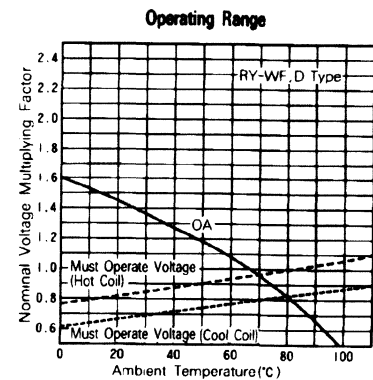
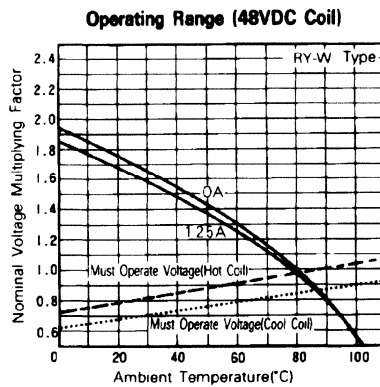
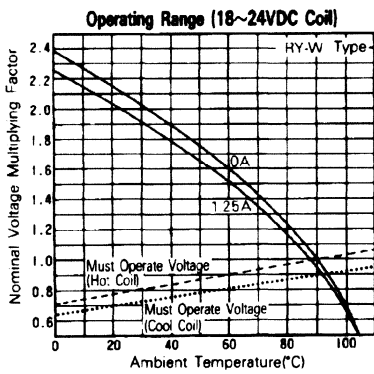
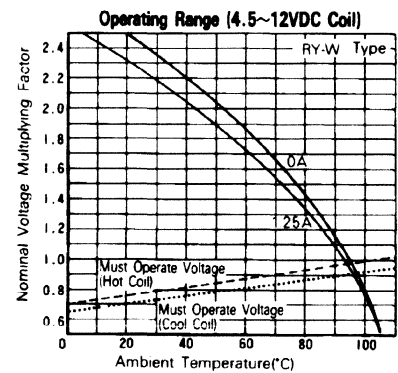
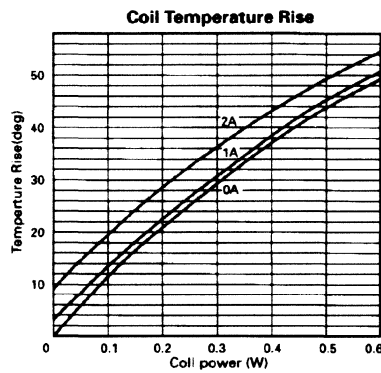
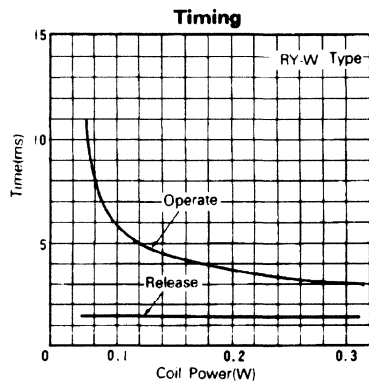
Note : All values in the table are measured at 20°C.

RY SERIES

| MODEL | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage | Nominal power |
|-----------------------|------------|-----------------|------------------------|----------------------|----------------------|---------------|
| Continuous (MBB) Type | RY-4.5 D-K | 4.5 VDC | 45Ω | 3.0 VDC | 0.23 VDC | 450 mW |
| | RY- 5 D-K | 5 VDC | 55Ω | 3.3 VDC | 0.25 VDC | 450 mW |
| | RY- 6 D-K | 6 VDC | 80Ω | 3.95 VDC | 0.3 VDC | 450 mW |
| | RY- 9 D-K | 9 VDC | 180Ω | 5.9 VDC | 0.45 VDC | 450 mW |
| | RY- 12 D-K | 12 VDC | 320Ω | 7.9 VDC | 0.6 VDC | 450 mW |
| | RY- 18 D-K | 18 VDC | 720Ω | 11.8 VDC | 0.9 VDC | 450 mW |
| | RY- 24 D-K | 24 VDC | 1,280Ω | 15.8 VDC | 1.2 VDC | 450 mW |
| | RY- 48 D-K | 48 VDC | 4,800Ω | 31.8 VDC | 2.4 VDC | 480 mW |

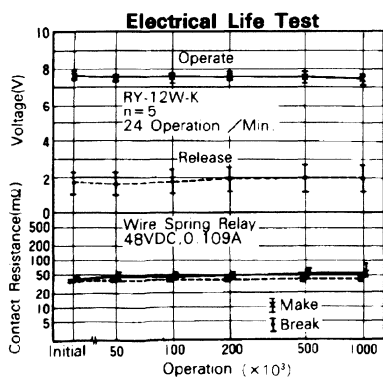
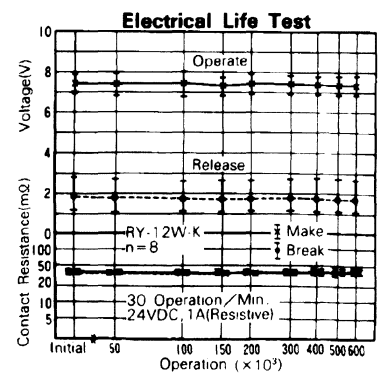
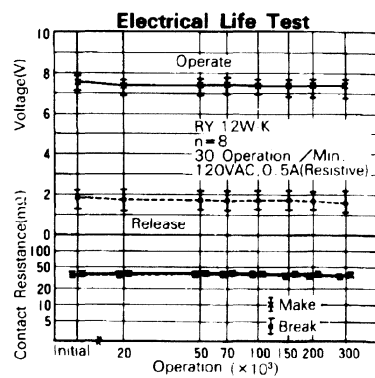
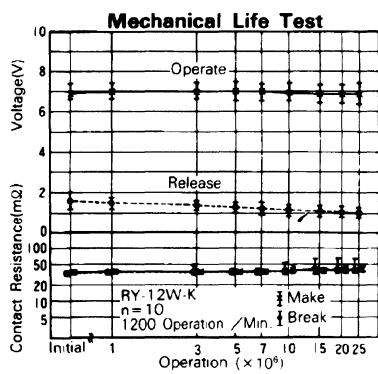
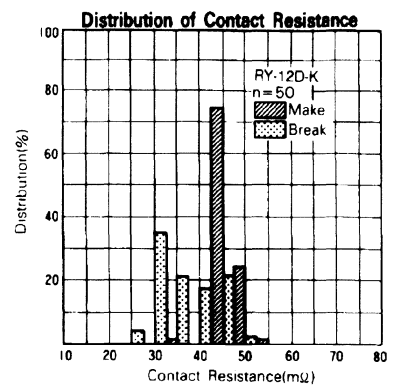
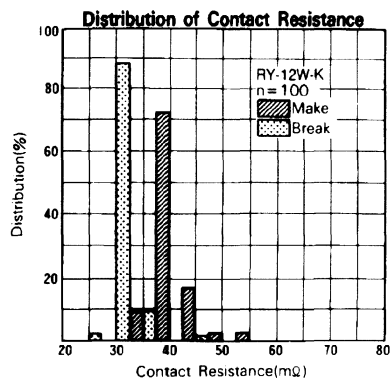
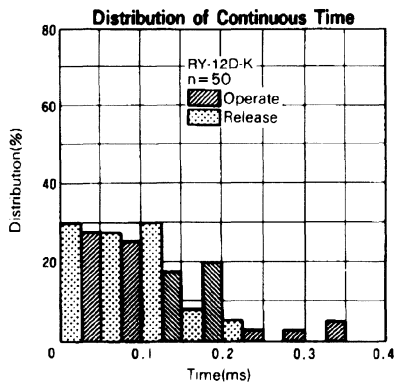
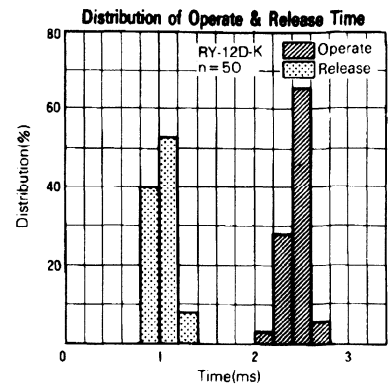
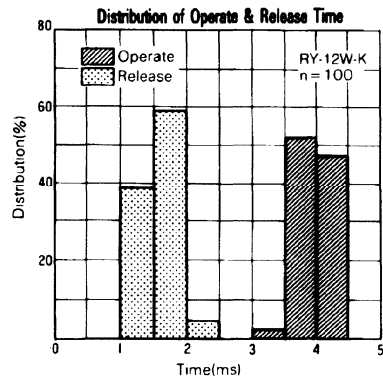
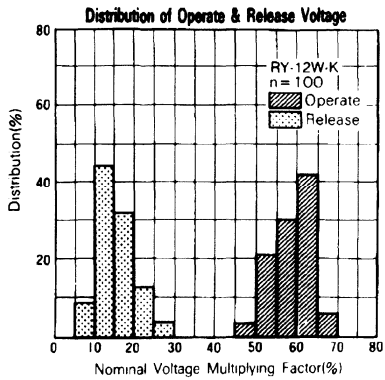
Note : All values in the table are measured at 20°C.

CHARACTERISTIC DATA



RY SERIES

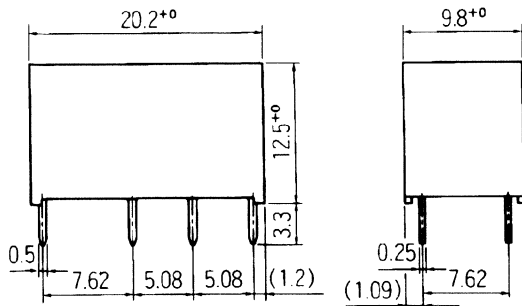
REFERENCE DATA



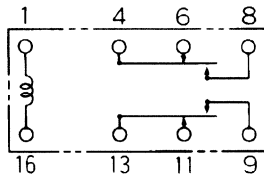
RY SERIES

■ DIMENSIONS

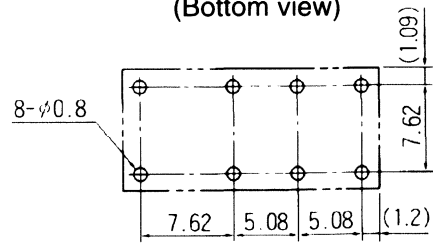
● Dimensions



● Schematics (Bottom view)



● PC board mounting hole layout (Bottom view)



Unit: mm

RY SERIES

NOTES



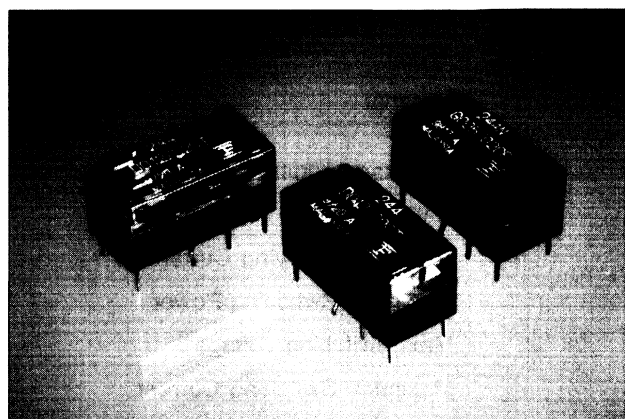
MINIATURE RELAY

2 POLES—1 to 2 A (FOR SIGNAL SWITCHING)

FBR244 SERIES

■ FEATURES

- Gold-overlay bifurcated contact
Contact material and shape especially suitable for signal switching; assures reliability at low level switching.
- Conforms to FCC68 standards
High voltage relays are also available with dielectric strength greater than 1,000 VAC and surge strength greater than 1,500 V.
- Formed terminals for temporary mounting
Kink terminals enable FBR240 Series relays to be mounted temporarily on a PC board.
- Automatic mounting
Shipped in carrier case plastic magazine suitable for automatic mounting.
- UL and CSA recognized



■ ORDERING INFORMATION

[Example] FBR244 N D 012 / 02C S -2 -CSA
(a) (b) (c) (d) (e) (f) (g) (h)

| | | |
|-----|------------------------------------|--|
| (a) | Series Name | FBR244: FBR244 Series |
| (b) | Enclosure | Nil : Flux free type N : Plastic sealed type |
| (c) | Coil Type | D : Standard (nominal power 0.5 W type) G : G type (nominal power 0.55 W type) |
| (d) | Nominal Voltage | (Example) Standard (Example) G type 003: 3 VDC 005: 4.5 VDC 012: 12 VDC 009: 9 VDC (refer to the COIL DATA CHART) |
| (e) | Contact Arrangement | 02C : 2 form C (DPDT) |
| (f) | Contact Style and Contact Material | T : Bifurcated, gold-overlay silver contact E : Bifurcated, gold-overlay silver-palladium contact S : Single, gold-overlay silver contact P : Single, gold-overlay silver-palladium contact |
| (g) | Special Type | Nil : Standard -2 : High dielectric strength type |
| (h) | Safety Specification | Nil : Standard -UL : UL114 recognized -CSA: UL114 + CSA recognized |

Note: The designation name is stamped on the top of the relay case as follows:
(Example) Designation ordered: FBR244D012/02CT
Stamp: 244D012/02CT

FBR244 SERIES

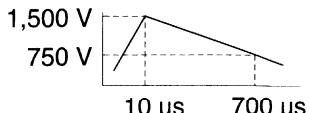
■ SAFETY STANDARD AND FILE NUMBERS

UL114 (File No. E63615)

C22.2 No. 14 (File No. LR40304 or LR64026)

| Nominal voltage | Contact rating |
|-----------------|---|
| 3 to 48 VDC | 2 A 28 VDC resistive 0.5 A 120 VAC resistive |

■ SPECIFICATIONS

| Item | | S contact | P contact | T contact | E contact |
|----------------|--|---|---|---------------------|-------------------------------|
| Contact | Arrangement | 2 form C (DPDT) | | | |
| | Style | Single | | Bifurcated | |
| | Material | Gold-overlay silver | Gold-overlay silver-palladium | Gold-overlay silver | Gold-overlay silver-palladium |
| | Resistance (initial) | Maximum 100 mΩ (at 0.1 A 6 VDC) | | | |
| | Ratings | 0.5 A 120 VAC or 1 A 30 VDC (resistive load) | | | |
| | Maximum Carrying Current | 2 A | | | |
| | Maximum Switching Power | 60 AV or 30 W | | | |
| | Max. Switching Voltage*1 | 220 VAC or 150 VDC | | | |
| | Maximum Switching Current | 1.25 A (AC) or 2 A (DC) | | | |
| | Min. applicable load*2 (Reference) | Plastic sealed | 1 mA 5 VDC | 1 mA 1 VDC | 1 mA 1 VDC |
| Flux free | | 5 mA 5 VDC | 1 mA 5 VDC | 1 mA 5 VDC | 1 mA 1 VDC |
| Coil | Nominal Power (at 20°C) | Approximately 0.5 W to 0.58 W (standard), approximately 0.55 W (G type) | | | |
| | Operate Power (at 20°C) | Approximately 0.28 W (standard), approximately 0.25 W (G type) | | | |
| | Operating Temperature | -30°C to +70°C (no frost) (refer to the CHARACTERISTIC DATA) | | | |
| | Operating Humidity | 45 to 85%RH | | | |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | | | |
| | Release (at nominal voltage) | Maximum 3 ms | | | |
| Insulation | Resistance (initial) | Minimum 100 MΩ (at 500 VDC) | | | |
| | Dielectric Strength | Between coil and contacts | 500 VAC 1 minute (standard) 1,000 VAC 1 minute (high dielectric strength type) | | |
| | | Between open contacts | 500 VAC 1 minute | | |
| Surge Strength | 1,500 V (at 10 x 700 μs) |  | | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | | |
| | Electrical (refer to the REFERENCE DATA) | DC | 500 x 10 ³ operations minimum (at contact rating) | | |
| | | AC | 100 x 10 ³ operations minimum (at contact rating) | | |
| Other | Vibration Resistance | 10 to 55 Hz (double amplitude of 1.5 mm) | | | |
| | Shock Resistance | Misoperation | 200 m/s ² (11 ± ¹ ms) | | |
| | | Endurance | 1,000 m/s ² (11 ± ¹ ms) | | |
| | Weight | Approximately 4.5 g | | | |

*1 If the switching voltage exceeds the rated contact voltage, reduce the current. The current values vary according to the type of load.

*2 Values when switching a resistive load at normal room temperature and humidity, and in a clean environment. The minimum switching load varies with the switching frequency and operation environment.

FBR244 SERIES

COIL DATA CHART

1. STANDARD (D type)

| MODEL | | Nominal voltage | Coil resistance $\pm 10\%$ | Nominal current (at nominal voltage) approx. | Must operate voltage | Must release voltage | Nominal power | Operate power | Coil temperature rise |
|---------------|----------------|-----------------|----------------------------|--|-----------------------------|-----------------------------|-------------------------------------|---------------------|-------------------------------------|
| S, P, T, E | | | | | | | | | |
| Flux free | Plastic sealed | | | | | | | | |
| FBR244D003/02 | FBR244ND003/02 | 3 VDC | 18 Ω | 167 mA | 75% max. of nominal voltage | 10% min. of nominal voltage | Approx. 500 mW (at nominal voltage) | Approx. 280 mW max. | Approx. 45 deg (at nominal voltage) |
| FBR244D005/02 | FBR244ND005/02 | 5 VDC | 50 Ω | 100 mA | | | | | |
| FBR244D006/02 | FBR244ND006/02 | 6 VDC | 72 Ω | 83 mA | | | | | |
| FBR244D009/02 | FBR244ND009/02 | 9 VDC | 162 Ω | 56 mA | | | | | |
| FBR244D012/02 | FBR244ND012/02 | 12 VDC | 290 Ω | 41 mA | | | | | |
| FBR244D024/02 | FBR244ND024/02 | 24 VDC | 1,150 Ω | 21 mA | | | | | |
| FBR244D048/02 | FBR244ND048/02 | 48 VDC | 4,000 Ω | 12 mA | | | 580 mW | | 53 deg |

Note: All values in the table are measured at 20°C.

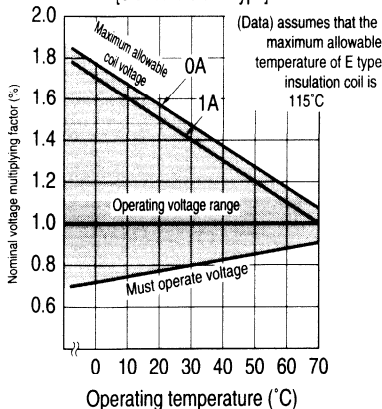
2. G TYPE

| MODEL | | Nominal voltage | Coil resistance $\pm 10\%$ | Nominal current (at nominal voltage) approx. | Must operate voltage | Must release voltage | Nominal power | Operate power | Coil temperature rise |
|---------------|----------------|-----------------|----------------------------|--|----------------------|----------------------|-------------------------------------|---------------------|-------------------------------------|
| S, P, T, E | | | | | | | | | |
| Flux free | Plastic sealed | | | | | | | | |
| FBR244G005/02 | FBR244ND005/02 | 4.5 VDC | 36 Ω | 125 mA | 3.1 VDC | 0.20 VDC | Approx. 550 mW (at nominal voltage) | Approx. 250 mW max. | Approx. 50 deg (at nominal voltage) |
| FBR244G006/02 | FBR244NG006/02 | 6 VDC | 66 Ω | 91 mA | 4.0 VDC | 0.27 VDC | | | |
| FBR244G009/02 | FBR244NG009/02 | 9 VDC | 140 Ω | 64 mA | 6.0 VDC | 0.38 VDC | | | |
| FBR244G012/02 | FBR244NG012/02 | 12 VDC | 280 Ω | 43 mA | 8.1 VDC | 0.55 VDC | | | |
| FBR244G024/02 | FBR244NG024/02 | 24 VDC | 1,050 Ω | 23 mA | 15.8 VDC | 1.06 VDC | | | |
| FBR244G048/02 | FBR244NG048/02 | 48 VDC | 4,100 Ω | 11 mA | 30.5 VDC | 2.12 VDC | | | |

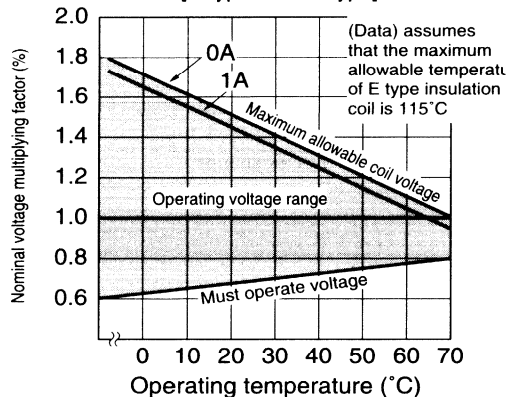
Note: All values in the table are measured at 20°C.

CHARACTERISTIC DATA

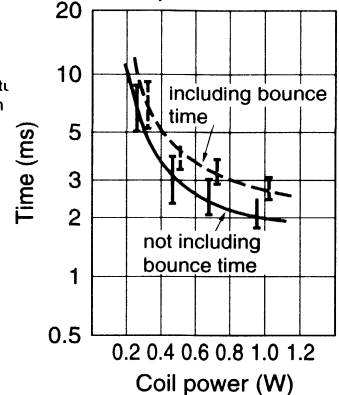
Range of operation temperature and voltage
[Standard 0.5 W type]



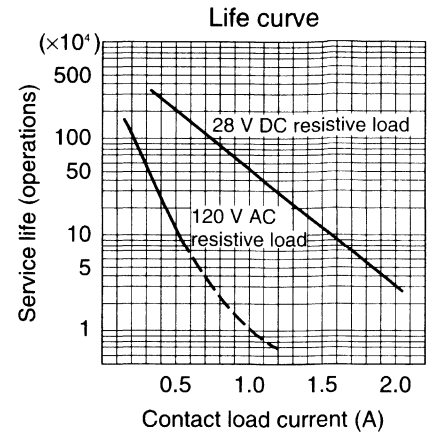
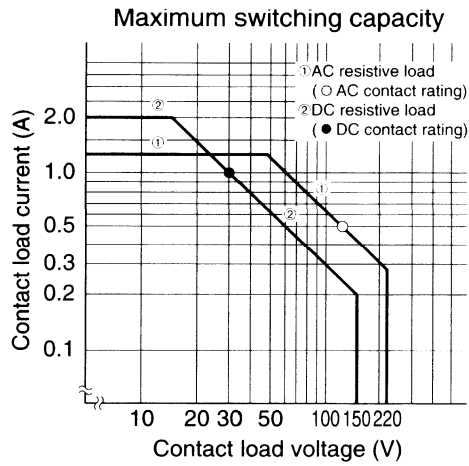
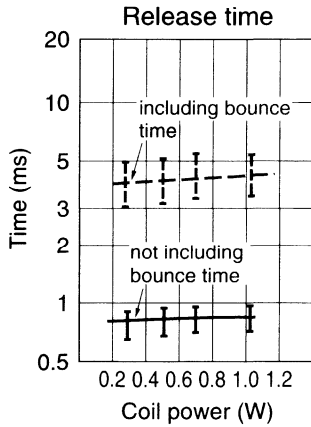
Range of operation temperature and voltage
[G type 0.55 W type]



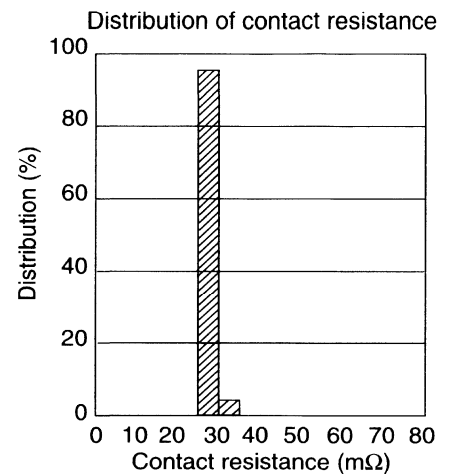
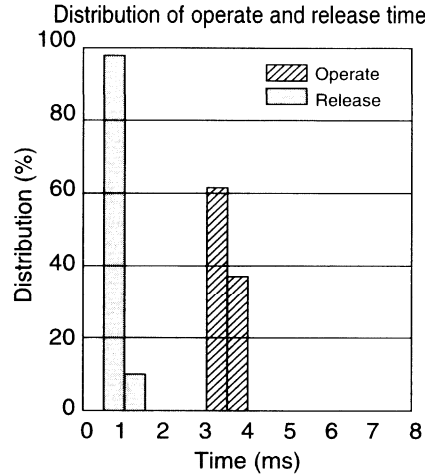
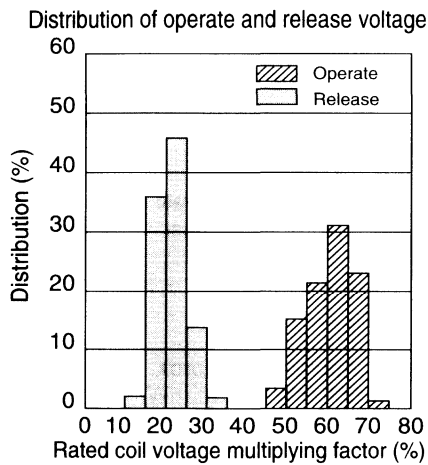
Operate time



FBR244 SERIES

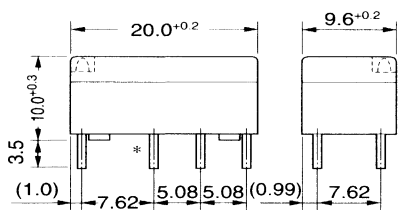


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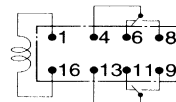


DIMENSIONS

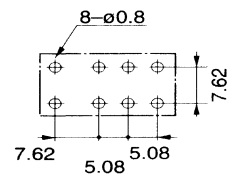
Dimensions



Schematic (BOTTOM VIEW)

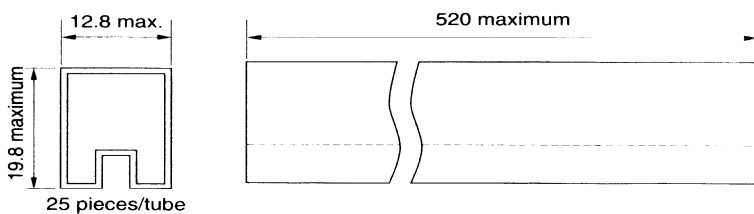


PC board mounting hole layout (BOTTOM VIEW)



*:The terminals marked with an asterisk are kinked for temporary mounting on PC board.

Tube carrier



Unit: mm

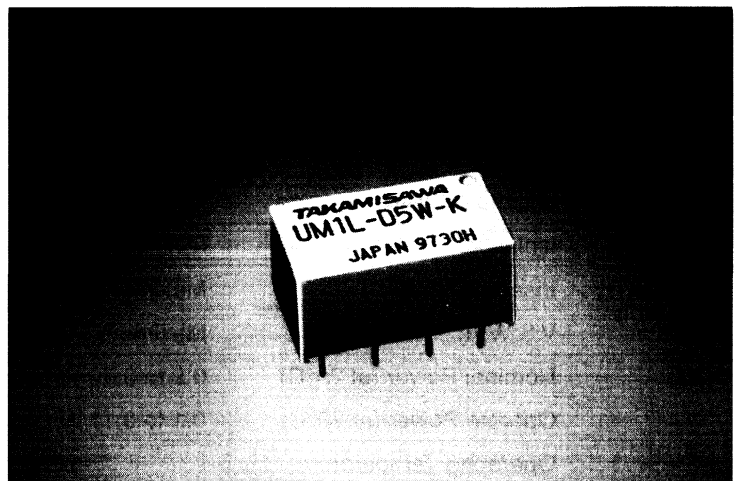
MINIATURE RELAY

1 POLE (HIGH FREQUENCY SIGNAL SWITCHING)

UM1 SERIES

■ FEATURES

- Subminiature polarized relay
- Excellent high frequency characteristics
 - Isolation : min. 60 dB
 - Insertion loss : max. 1 dB
 - V.S.W.R. : max. 1.2
 } at 900 MHz
 (Impedance of the measuring devices is 75Ω)
- High reliability—Bifurcated contacts
- Wide operating range
- DIL pitch terminals
- Plastic sealed type backfilled with nitrogen
- Latching type available



■ ORDERING INFORMATION

[Example] $\frac{UM1}{(a)} \frac{L}{(b)} - \frac{D}{(c)} \frac{12}{(d)} \frac{W}{(e)} - \frac{K}{(f)}$

| | | |
|-----|--------------------|--|
| (a) | Series Name | UM1: UM1 Series |
| (b) | Operation Function | Nil : Standard type L : Latching type |
| (c) | Number of Coil | Nil : Single winding type D : Double winding type |
| (d) | Nominal Voltage | Refer to the COIL DATA CHART |
| (e) | Contact | W : Bifurcated type |
| (f) | Enclosure | K : Plastic sealed type |

UM1 SERIES

■ SPECIFICATIONS

| Item | | Standard Type | Single Winding Latching Type | Double Winding Latching Type |
|--|------------------------------|---|--|------------------------------|
| | | UM1-() W-K | UM1L-() W-K | UM1L-D () W-K |
| Contact | Arrangement | 1 form C (SPDT) | | |
| | Material | Gold clad (stationary contact), gold plate (movable contact) | | |
| | Style | Bifurcated | | |
| | Resistance (initial) | Maximum 100 mΩ | | |
| | Rating (resistive) | 10 mA 24 VDC 1 W (at 900 MHz) | | |
| | Maximum Carrying Current | 0.5 A | | |
| | Maximum Switching Power | 1 W (DC) 10 W (at 900 MHz) | | |
| | Maximum Switching Voltage | 30 VDC | | |
| | Maximum Switching Current | 100 mA | | |
| | Minimum Switching Load*1 | 0.01 mA 10 mVDC | | |
| Excellent High Frequency Characteristics | Isolation | Minimum 60 dB (at 900 MHz), impedance of the measuring devices is 75Ω | | |
| | Insertion Loss | Maximum 1 dB (at 900 MHz), impedance of the measuring devices is 75Ω | | |
| | V.S.W.R. | Maximum 1.2 (at 900 MHz), impedance of the measuring devices is 75Ω | | |
| Coil | Nominal Power (at 20°C) | 0.2 to 0.22 W | 0.2 W | 0.4 W |
| | Operate Power (at 20°C) | 0.1 to 0.11 W | 0.1 W | 0.2 W |
| | Operating Temperature | -30°C to +80°C (no frost) | | -30°C to +60°C (no frost) |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | Maximum 6 ms (set) | |
| | Release (at nominal voltage) | Maximum 5 ms | Maximum 6 ms (reset) | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | |
| | Dielectric Strength | between open contacts between contacts and shield terminals | 500 VAC 1 minute | |
| | | between coil and contacts, between coil and shield terminals | 1,000 VAC 1 minute | |
| Life | Mechanical | 1 x 10 ⁶ operations minimum | | |
| | Electrical | 300 x 10 ³ operations minimum (at nominal load) | | |
| Other | Vibration | Misoperation | 10 to 55 Hz (double amplitude of 3.3 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 5.0 mm) | |
| | Shock | Misoperation | 500 m/s ² (11 ±1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| | Weight | Approximately 4 g | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

UM1 SERIES

■ COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance (±10%) | Must operate voltage* ¹ | Must release voltage* ¹ | Nominal power |
|---------------|--------------|-----------------|------------------------|------------------------------------|------------------------------------|---------------|
| Standard Type | UM1- 1.5 W-K | 1.5 VDC | 11.2 Ω | +1.05 VDC | +0.08 VDC | 200 mW |
| | UM1- 3 W-K | 3 VDC | 45 Ω | +2.1 VDC | +0.15 VDC | 200 mW |
| | UM1- 4.5 W-K | 4.5 VDC | 101 Ω | +3.15 VDC | +0.23 VDC | 200 mW |
| | UM1- 5 W-K | 5 VDC | 125 Ω | +3.5 VDC | +0.25 VDC | 200 mW |
| | UM1- 6 W-K | 6 VDC | 180 Ω | +4.2 VDC | +0.3 VDC | 200 mW |
| | UM1- 9 W-K | 9 VDC | 405 Ω | +6.3 VDC | +0.45 VDC | 200 mW |
| | UM1- 12 W-K | 12 VDC | 720 Ω | +8.4 VDC | +0.6 VDC | 200 mW |
| | UM1- 18 W-K | 18 VDC | 1,620 Ω | +12.6 VDC | +0.9 VDC | 200 mW |
| | UM1- 24 W-K | 24 VDC | 2,880 Ω | +16.8 VDC | +1.2 VDC | 200 mW |
| | UM1- 48 W-K | 48 VDC | 10,472 Ω | +33.6 VDC | +2.4 VDC | 220 mW |

Note: *1 Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

UM1 SERIES

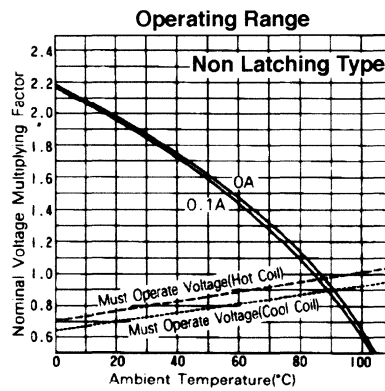
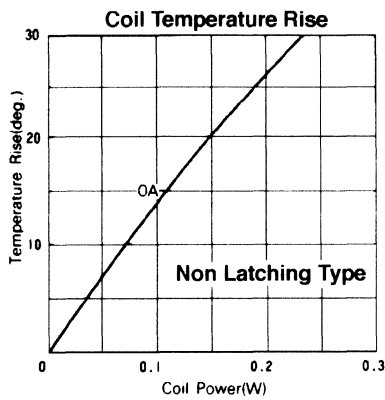
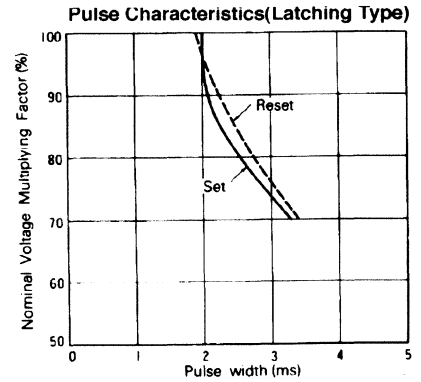
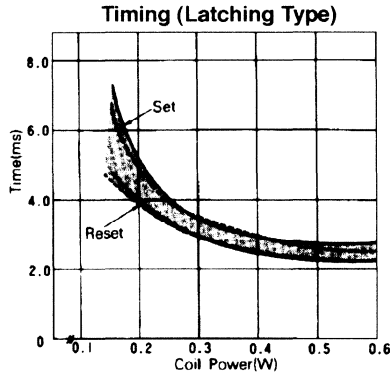
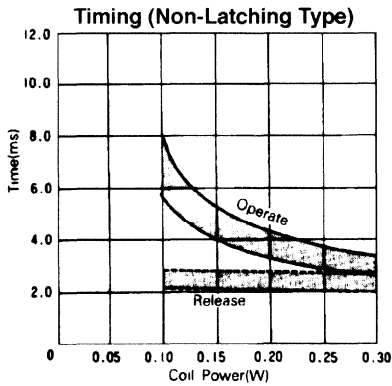
| MODEL | | Nominal voltage | Coil resistance (±10%) | Set voltage*1 | Reset voltage*1 | Nominal power |
|------------------------------|---------------|-----------------|------------------------|---------------|-----------------|---------------|
| Single Winding Latching Type | UM1L- 1.5 W-K | 1.5 VDC | 11.2 Ω | +1.05 VDC | -1.05 VDC | 200 mW |
| | UM1L- 3 W-K | 3 VDC | 45 Ω | +2.1 VDC | -2.1 VDC | 200 mW |
| | UM1L- 4.5 W-K | 4.5 VDC | 101 Ω | +3.15 VDC | -3.15 VDC | 200 mW |
| | UM1L- 5 W-K | 5 VDC | 125 Ω | +3.5 VDC | -3.5 VDC | 200 mW |
| | UM1L- 6 W-K | 6 VDC | 180 Ω | +4.2 VDC | -4.2 VDC | 200 mW |
| | UM1L- 9 W-K | 9 VDC | 405 Ω | +6.3 VDC | -6.3 VDC | 200 mW |
| | UM1L- 12 W-K | 12 VDC | 720 Ω | +8.4 VDC | -8.4 VDC | 200 mW |
| | UM1L- 18 W-K | 18 VDC | 1,620 Ω | +12.6 VDC | -12.6 VDC | 200 mW |
| | UM1L- 24 W-K | 24 VDC | 2,880 Ω | +16.8 VDC | -16.8 VDC | 200 mW |
| | UM1L- 48 W-K | 48 VDC | 11,520 Ω | +33.6 VDC | -33.6 VDC | 200 mW |
| Double Winding Latching Type | UM1L-D1.5 W-K | 1.5 VDC | P 5.6 Ω | +1.05 VDC | +1.05 VDC | 400 mW |
| | | | S 5.6 Ω | | | |
| | UM1L-D 3 W-K | 3 VDC | P 22.5 Ω | +2.1 VDC | +2.1 VDC | 400 mW |
| | | | S 22.5 Ω | | | |
| | UM1L-D4.5 W-K | 4.5 VDC | P 50.6 Ω | +3.15 VDC | +3.15 VDC | 400 mW |
| | | | S 50.6 Ω | | | |
| | UM1L-D 5 W-K | 5 VDC | P 62.5 Ω | +3.5 VDC | +3.5 VDC | 400 mW |
| | | | S 62.5 Ω | | | |
| | UM1L-D 6 W-K | 6 VDC | P 90 Ω | +4.2 VDC | +4.2 VDC | 400 mW |
| | | | S 90 Ω | | | |
| | UM1L-D 9 W-K | 9 VDC | P 202.5 Ω | +6.3 VDC | +6.3 VDC | 400 mW |
| | | | S 202.5 Ω | | | |
| | UM1L-D 12 W-K | 12 VDC | P 360 Ω | +8.4 VDC | +8.4 VDC | 400 mW |
| | | | S 360 Ω | | | |
| UM1L-D 18 W-K | 18 VDC | P 810 Ω | +12.6 VDC | +12.6 VDC | 400 mW | |
| | | S 810 Ω | | | | |
| UM1L-D 24 W-K | 24 VDC | P 1,440 Ω | +16.8 VDC | +16.8 VDC | 400 mW | |
| | | S 1,440 Ω | | | | |
| UM1L-D 48 W-K | 48 VDC | P 5,760 Ω | +33.6 VDC | +33.6 VDC | 400 mW | |
| | | S 5,760 Ω | | | | |

Note: *1 Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

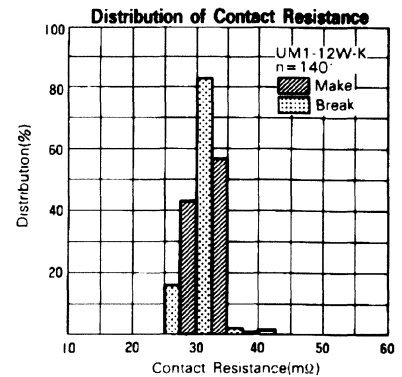
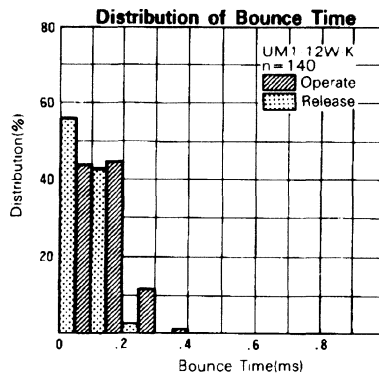
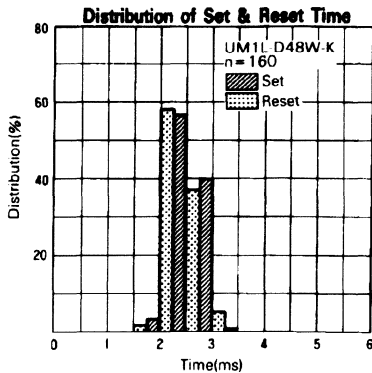
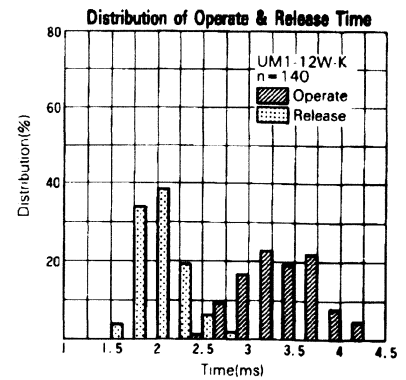
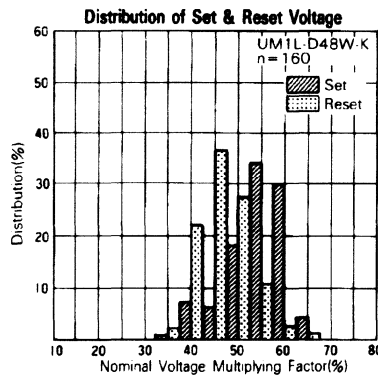
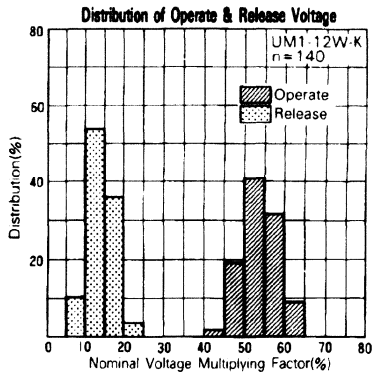
P: Primary coil S: Secondary coil

UM1 SERIES

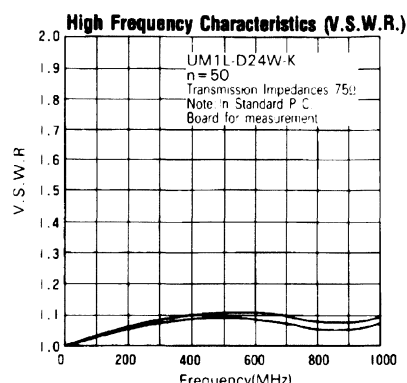
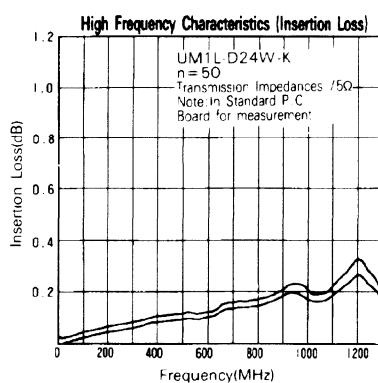
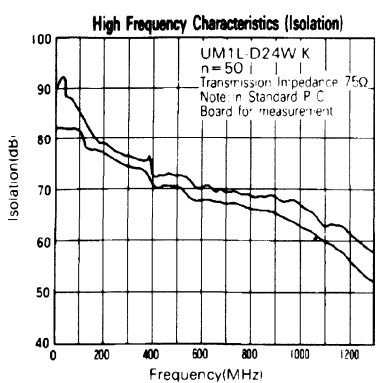
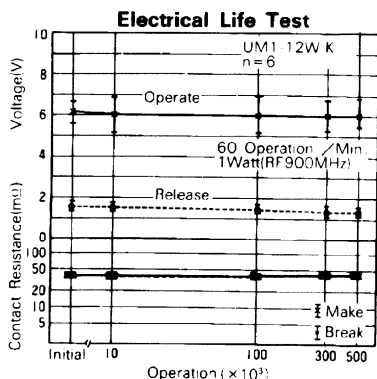
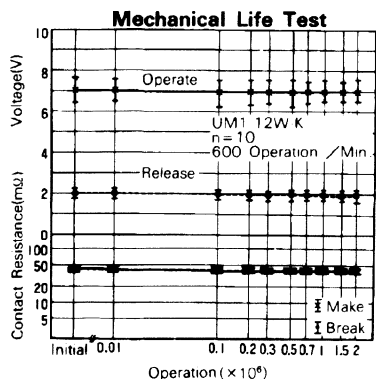
CHARACTERISTIC DATA



REFERENCE DATA



UM1 SERIES



■ DIMENSIONS

● Dimensions

● Schematics

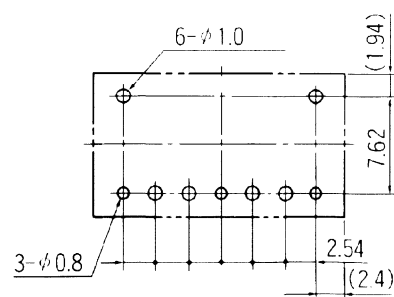
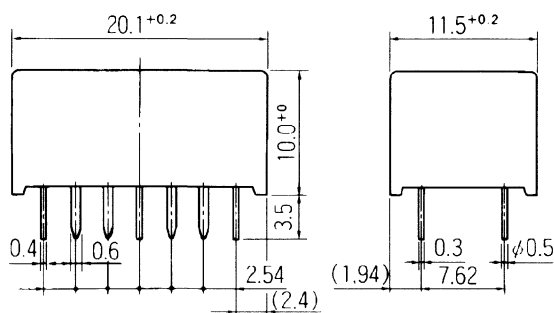
(Bottom view)

● PC board mounting

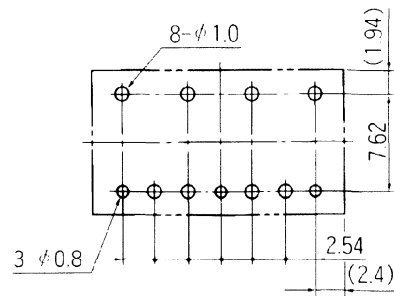
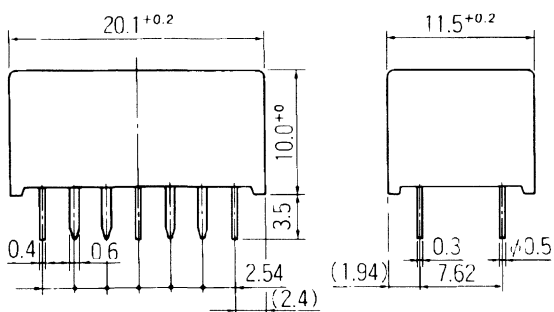
hole layout

(Bottom view)

UM1, UM1L type (Non-latching type, single winding latching type)



UM1L-D type (Double winding latching type)



Unit: mm

MINIATURE RELAY

2 POLES (HIGH FREQUENCY SIGNAL SWITCHING)

UR1 SERIES

■ FEATURES

- Subminiature polarized relay
- Excellent high frequency characteristics
 - Isolation : minimum 60 dB
 - Insertion loss: maximum 1 dB
 - V.S.W.R. : maximum 1.2
 } at 900 MHz
 (Impedance of the measuring devices is 75Ω)
- High reliability—Bifurcated contacts
- Wide operating range
- DIL pitch terminals
- Plastic sealed type backfilled with nitrogen
- Latching type available



■ ORDERING INFORMATION

[Example] $\frac{UR1}{(a)}$ $\frac{L}{(b)}$ - $\frac{D}{(c)}$ $\frac{12}{(d)}$ $\frac{W}{(e)}$ - $\frac{K}{(f)}$

| | | |
|-----|--------------------|--|
| (a) | Series Name | UR1: UR1 series |
| (b) | Operation Function | Nil : Standard type L : Latching type |
| (c) | Number of Coil | Nil : Single winding type D : Double winding type |
| (d) | Nominal Voltage | Refer to the COIL DATA CHART |
| (e) | Contact | W : Bifurcated type |
| (f) | Enclosure | K : Plastic sealed type |

UR1 SERIES

■ SPECIFICATIONS

| Item | | Standard Type | Single Winding Latching Type | Double Winding Latching Type |
|--|------------------------------|---|---|------------------------------|
| | | UR1-() W-K | UR1L-() W-K | UR1L-D () W-K |
| Contact | Arrangement | 2 form C (DPDT) | | |
| | Material | Gold clad (stationary contact), gold plate (movable contact) | | |
| | Style | Bifurcated | | |
| | Resistance (initial) | Maximum 100 mΩ | | |
| | Rating (resistive) | 10 mA 24 VDC 1 W (at 900 MHz) | | |
| | Maximum Carrying Current | 0.5 A | | |
| | Maximum Switching Power | 1 W (DC) 10 W (at 900 MHz) | | |
| | Maximum Switching Voltage | 30 VDC | | |
| | Maximum Switching Current | 100 mA | | |
| | Minimum Switching Load*1 | 0.01 mA 10 mVDC | | |
| Excellent High Frequency Characteristics | Isolation | Minimum 60 dB (at 900 MHz), impedance of the measuring devices is 75Ω | | |
| | Insertion Loss | Maximum 1 dB (at 900 MHz), impedance of the measuring devices is 75Ω | | |
| | V.S.W.R. | Maximum 1.2 (at 900 MHz), impedance of the measuring devices is 75Ω | | |
| Coil | Nominal Power (at 20°C) | 0.36 to 0.43 W | 0.25 W | 0.5 to 0.55 W |
| | Operate Power (at 20°C) | 0.18 to 0.2 W | 0.125 W | 0.25 to 0.27 W |
| | Operating Temperature | -30°C to +80°C no frost) | | -30°C to +70°C (no frost) |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | Maximum 6 ms (set) | |
| | Release (at nominal voltage) | Maximum 4 ms | Maximum 6 ms (reset) | |
| Insulation | Resistance (at 500 VDC) | | Minimum 1,000 MΩ | |
| | Dielectric Strength | between open contacts between contacts and shield terminals | 500 VAC 1 minute | |
| | | between coil and con- tacts between coil and shield terminals | 1,000 VAC 1 minute | |
| Life | Mechanical | | 1 x 10 ⁶ operations minimum | |
| | Electrical | | 300 x 10 ³ operations minimum (contact rating) | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 3.3 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 5.0 mm) | |
| | Shock Resistance | Misoperation | 500 m/s ² (11 ±1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| | Weight | | Approximately 7 g | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

UR1 SERIES

■ COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance (±10%) | Must operate voltage* ¹ | Must release voltage* ¹ | Nominal power |
|---------------|--------------|-----------------|------------------------|------------------------------------|------------------------------------|---------------|
| Standard Type | UR1- 1.5 W-K | 1.5 VDC | 5.3Ω | +1.05 VDC | +0.08 VDC | 425 mW |
| | UR1- 3 W-K | 3 VDC | 25 Ω | +2.1 VDC | +0.15 VDC | 360 mW |
| | UR1- 4.5 W-K | 4.5 VDC | 56.3Ω | +3.15 VDC | +0.23 VDC | 360 mW |
| | UR1- 5 W-K | 5 VDC | 69.5Ω | +3.5 VDC | +0.25 VDC | 360 mW |
| | UR1- 6 W-K | 6 VDC | 100 Ω | +4.2 VDC | +0.3 VDC | 360 mW |
| | UR1- 9 W-K | 9 VDC | 225 Ω | +6.3 VDC | +0.45 VDC | 360 mW |
| | UR1- 12 W-K | 12 VDC | 400 Ω | +8.4 VDC | +0.6 VDC | 360 mW |
| | UR1- 18 W-K | 18 VDC | 900 Ω | +12.6 VDC | +0.9 VDC | 360 mW |
| | UR1- 24 W-K | 24 VDC | 1,600 Ω | +16.8 VDC | +1.2 VDC | 360 mW |
| | UR1- 48 W-K | 48 VDC | 5,900 Ω | +33.6 VDC | +2.4 VDC | 390 mW |

Note: *¹ Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

UR1 SERIES

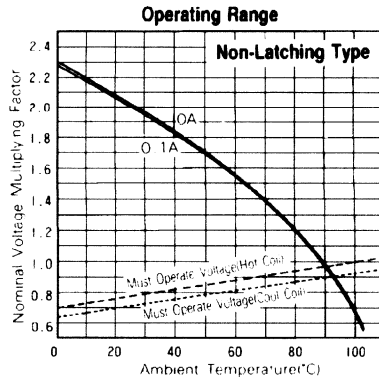
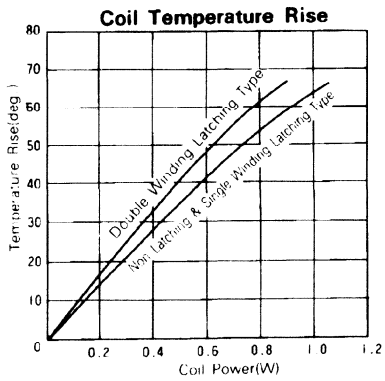
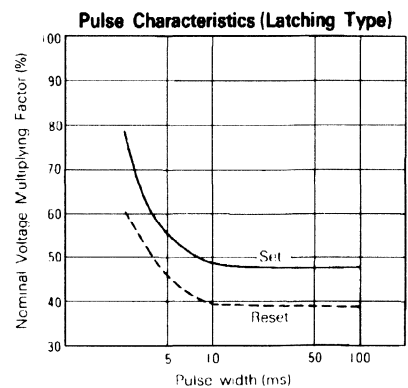
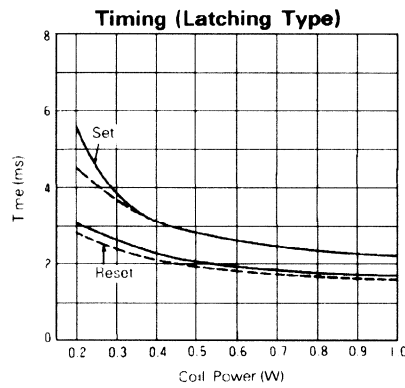
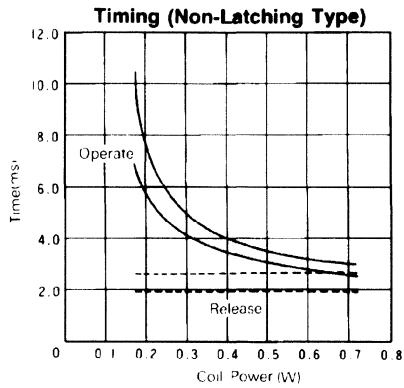
| MODEL | | Nominal Voltage | Coil Resistance ($\pm 10\%$) | Set Voltage* ¹ | Reset Voltage* ¹ | Nominal Power |
|------------------------------|----------------|------------------|--------------------------------|---------------------------|-----------------------------|---------------|
| Single Winding Latching Type | UR1L- 1.5 W-K | 1.5 VDC | 9 Ω | +1.05 VDC | -1.05 VDC | 250 mW |
| | UR1L- 3 W-K | 3 VDC | 36 Ω | +2.1 VDC | -2.1 VDC | 250mW |
| | UR1L- 4.5 W-K | 4.5 VDC | 80 Ω | +3.15 VDC | -3.15 VDC | 250 mW |
| | UR1L- 5 W-K | 5 VDC | 100 Ω | +3.5 VDC | -3.5 VDC | 250 mW |
| | UR1L- 6 W-K | 6 VDC | 144 Ω | +4.2 VDC | -4.2 VDC | 250 mW |
| | UR1L- 9 W-K | 9 VDC | 324 Ω | +6.3 VDC | -6.3 VDC | 250 mW |
| | UR1L- 12 W-K | 12 VDC | 576 Ω | +8.4 VDC | -8.4 VDC | 250 mW |
| | UR1L- 18 W-K | 18 VDC | 1,296 Ω | +12.6 VDC | -12.6 VDC | 250 mW |
| | UR1L- 24 W-K | 24 VDC | 2,304 Ω | +16.8 VDC | -16.8 VDC | 250 mW |
| | UR1L- 48 W-K | 48 VDC | 9,216 Ω | +33.6 VDC | -33.6 VDC | 250 mW |
| Double Winding Latching Type | UR1L-D 1.5 W-K | 1.5 VDC | P 4.5 Ω | +1.05 VDC | | 500 mW |
| | | | S 4.5 Ω | | +1.05 VDC | |
| | UR1L-D 3 W-K | 3 VDC | P 18 Ω | +2.1 VDC | | 500 mW |
| | | | S 18 Ω | | +2.1 VDC | |
| | UR1L-D 4.5 W-K | 4.5 VDC | P 40.5 Ω | +3.15 VDC | | 500 mW |
| | | | S 40.5 Ω | | +3.15 VDC | |
| | UR1L-D 5 W-K | 5 VDC | P 50 Ω | +3.5 VDC | | 500 mW |
| | | | S 50 Ω | | +3.5 VDC | |
| | UR1L-D 6 W-K | 6 VDC | P 72 Ω | +4.2 VDC | | 500 mW |
| | | | S 72 Ω | | +4.2 VDC | |
| | UR1L-D 9 W-K | 9 VDC | P 162 Ω | +6.3 VDC | | 500 mW |
| | | | S 162 Ω | | +6.3 VDC | |
| | UR1L-D 12 W-K | 12 VDC | P 288 Ω | +8.4 VDC | | 500 mW |
| | | | S 288 Ω | | +8.4 VDC | |
| | UR1L-D 18 W-K | 18 VDC | P 648 Ω | +12.6 VDC | | 500 mW |
| | | | S 648 Ω | | +12.6 VDC | |
| | UR1L-D 24 W-K | 24 VDC | P 1,152 Ω | +16.8 VDC | | 500 mW |
| | | | S 1,152 Ω | | +16.8 VDC | |
| UR1L-D 48 W-K | 48 VDC | P 4,189 Ω | +33.6 VDC | | 550 mW | |
| | | S 4,189 Ω | | +33.6 VDC | | |

Note: *¹ Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

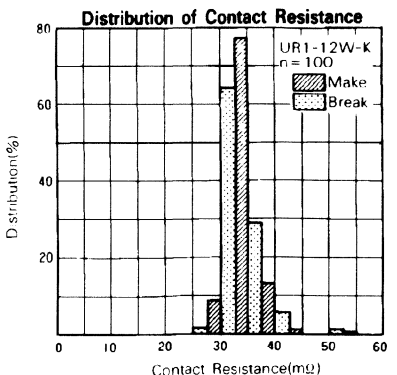
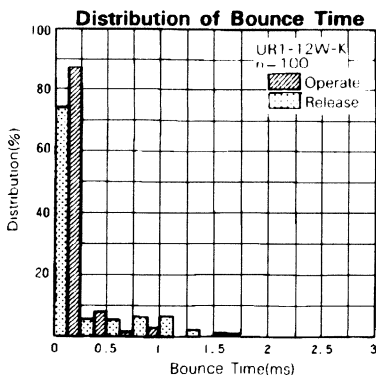
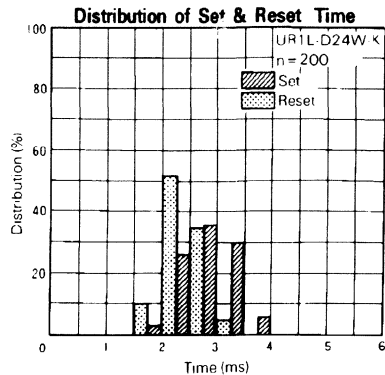
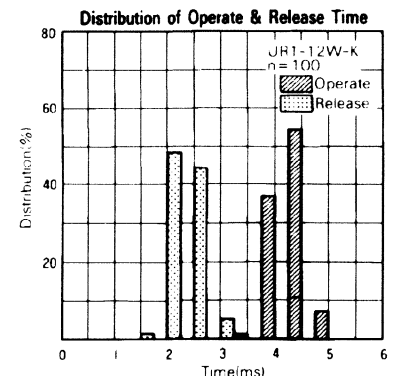
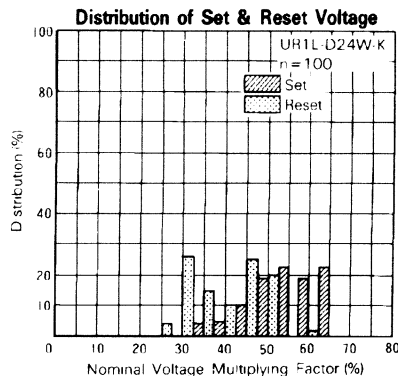
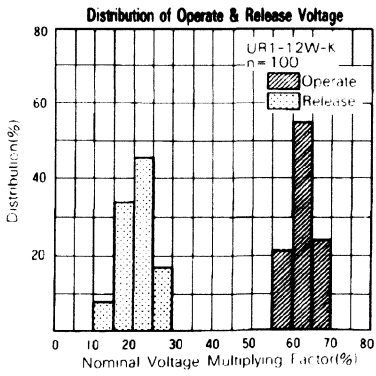
P: Primary coil S: Secondary coil

UR1 SERIES

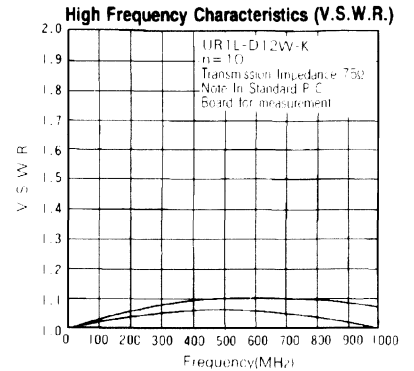
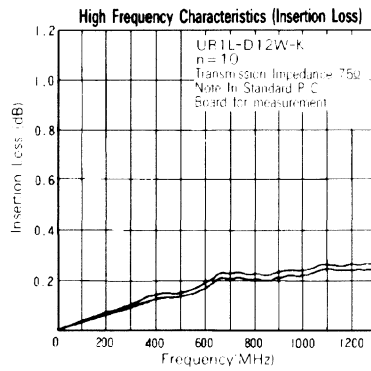
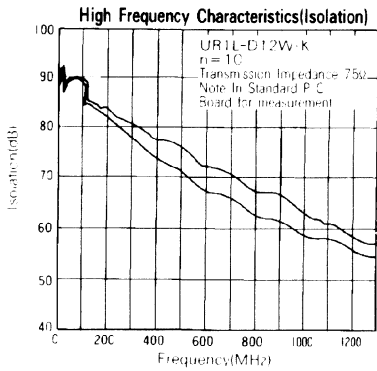
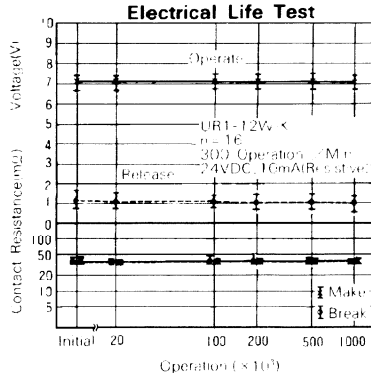
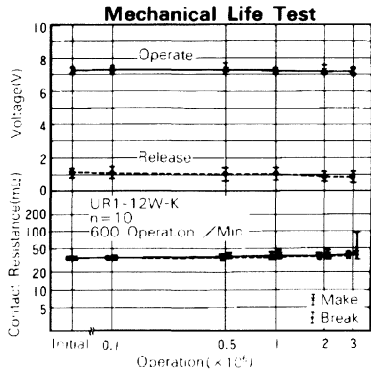
CHARACTERISTIC DATA



REFERENCE DATA



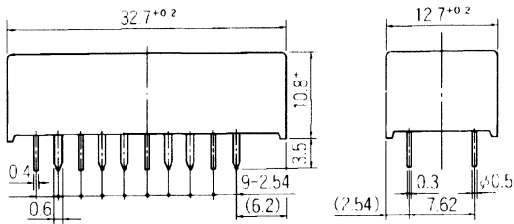
UR1 SERIES



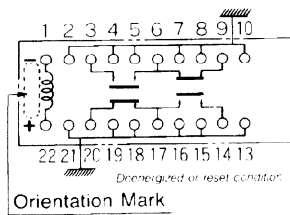
■ DIMENSIONS

● Dimensions

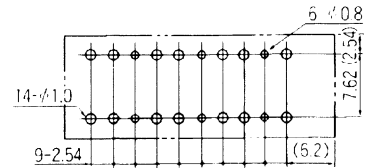
UR1, UR1L, type (Non-latching type, Single winding latching type)



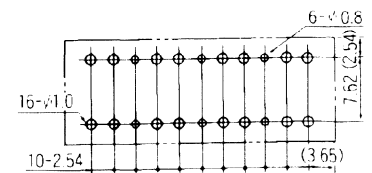
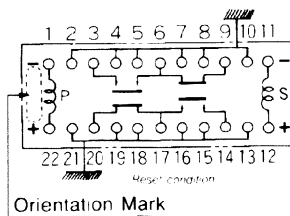
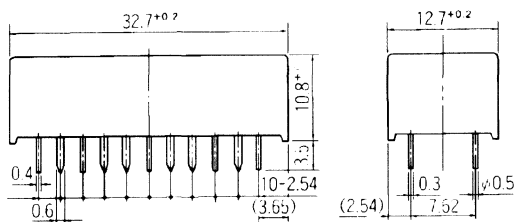
● Schematics (BOTTOM VIEW)



● PC board mounting hole layout (BOTTOM VIEW)



UR1L-D type (Double winding latching type)



Unit: mm

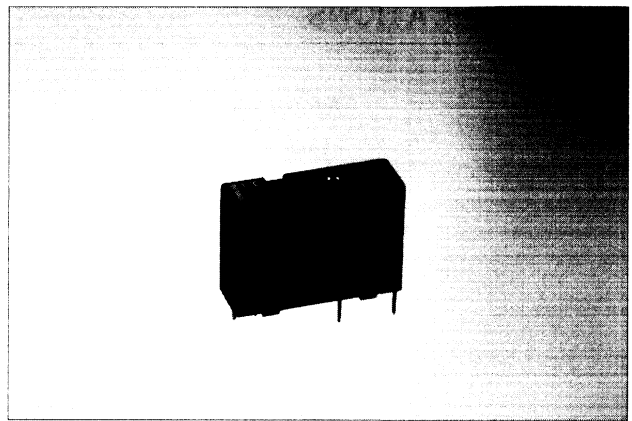
POWER RELAY

1 POLE 3A SLIM TYPE RELAY

FTR-F3 SERIES

■ FEATURES

- HIGH DENSITY MOUNTING
Saves Space by 20% Compared to JV type.
- HIGH ISOLATION
Insulation Distance: Minimum 6mm between coil and contact (conforms to IEC 65)
Dielectric Strength: 4KV
Surge Strength: 10KV
- HIGH COIL SENSITIVITY
Nominal coil power consumption of 200mW
- HIGH FLAMMABILITY RESISTANCE
Flammability grade of 94V-0 materials employed
- CADMIUM FREE CONTACT FOR ECO-PROGRAM
- SAFETY STANDARDS
UL, CSA, VDE approved, SEMKO pending



■ ORDERING INFORMATION

[Example] FTR-F3 A A 012 E -**
 (a) (b) (c) (d) (e) (f)

| | | | |
|-----|----------------------|--|--------------------|
| (a) | Series Name | FTR-F3 | |
| (b) | Contact Arrangement | A | : Form A |
| (c) | Coil Type | A | : Standard (200mW) |
| (d) | Coil Nominal Voltage | 005 : 5DC | 012 : 12DC |
| | | 006 : 6DC | 018 : 18DC |
| | | 009 : 9DC | 024 : 24DC |
| (e) | Contact Material | E | : Silver alloy |
| (f) | Custom Designation | Special Number for Customized Products | |

Remarks: Actual marking on relay would not carry code FTR and be as below:

Ordering code Actual marking
FTR-F3AA012E → F3AA012E

FTR-F3 Series

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E63614)

C22.2 No. 14 (File No. LR40304)

VDE 0435 (License # 6856 UG)

Please note that UL/CSA ratings may differ from the standard ratings.

Please request when the approval markings are required on the cover and/or relay recognized by SEV is required.

| Nominal Voltage | Contact Rating |
|-----------------|--|
| 5 to 24 VDC | 1/8 HP 277 VAC 1/10 HP 125VAC 3A 30 VDC/277 VAC res. Pilot duty D300 |

■ SPECIFICATIONS

| Item | | FTR-F3 Series | |
|----------------|--|--|--|
| Contact | Arrangement | 1 Form A (SPST-NO) | |
| | Material | Silver Alloy | |
| | Resistance (initial) | Maximum 100mΩ (at 1A 6VDC) | |
| | Rating (resistive) | 250 VAC/30 VDC, 3A | |
| | Maximum Switching Current | 3A | |
| | Maximum Carrying Rating | 5A | |
| | Maximum Switching Power | 750 VA/90 W | |
| | Maximum Switching Voltage* ¹ | 277VAC / 30VDC | |
| | Minimum Switching Load | 10mA, 5VDC | |
| Coil | Nominal Power (at 20° C) | 0.2W | |
| | Operate Power (at 20° C) | 0.11W | |
| | Operating Temperature | -40° C ~ +70° C (no frost) | |
| Time Value | Operate Time (at nominal voltage) | Maximum 10ms | |
| | Release Time (at nominal voltage) | Maximum 10ms | |
| Insulation | Resistance (at 500VDC) | Minimum 1,000 MΩ | |
| | Dielectric Strength | between open contacts | 750 VAC 1 minute |
| | | between coil and contacts | 4,000 VAC 1 minute |
| Surge Strength | 10,000V / 1.2 x 50 μs Between Coil and Contacts | | |
| Life | Mechanical | 5 x 10 ⁶ operations minimum | |
| | Electrical | Contact Rating | 200 x 10 ³ operations minimum |
| Vibration | Misoperation | 10-55 Hz (double amplitude of 1.5mm) | |
| | Endurance | 10-55 Hz (double amplitude of 1.5mm) | |
| Shock | Misoperation | 100m/s ² (11±1ms) | |
| | Endurance | 1,000m/s ² (6±1ms) | |
| Weight | Approximately 4g | | |

*¹ Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

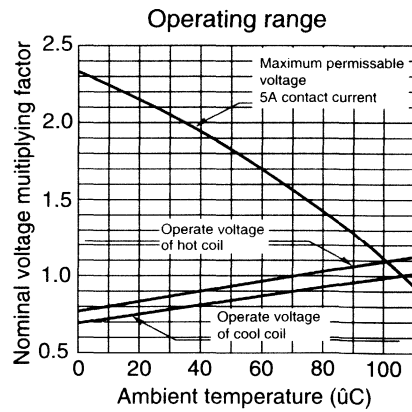
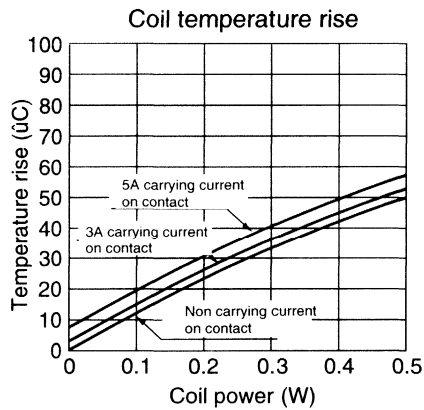
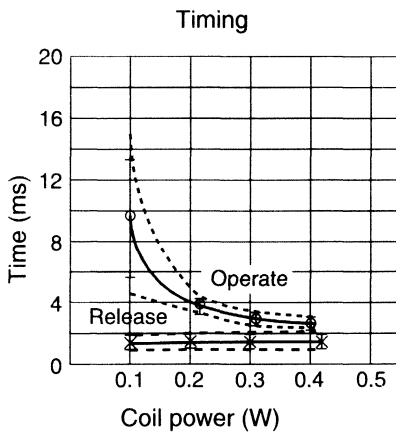
FTR-F3 SERIES

COIL DATA CHART

| MODEL | Nominal Voltage | Coil Resistance | Operate Voltage | Release Voltage | Nominal Power |
|--------------|-----------------|-----------------|-----------------|-----------------|---------------|
| FTR-F3AA005E | 5VDC | 125 Ω | 3.75VDC | 0.5VDC | 200mw |
| FTR-F3AA006E | 6VDC | 180 Ω | 4.5VDC | 0.6VDC | 200mw |
| FTR-F3AA009E | 9VDC | 405 Ω | 6.75VDC | 0.9VDC | 200mw |
| FTR-F3AA012E | 12VDC | 720 Ω | 9.0VDC | 1.2VDC | 200mw |
| FTR-F3AA018E | 18VDC | 1,620 Ω | 13.5VDC | 1.8VDC | 200mw |
| FTR-F3AA024E | 24VDC | 2,880 Ω | 18.0VDC | 2.4VDC | 200mw |

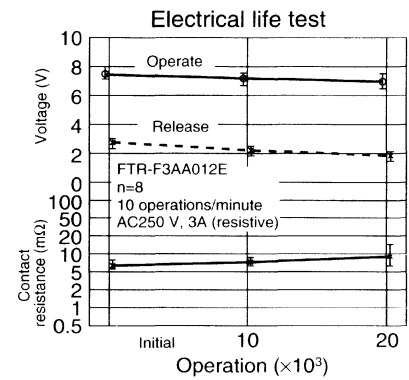
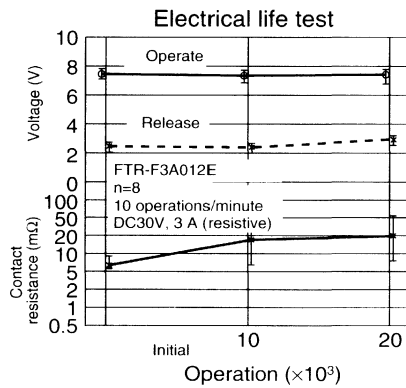
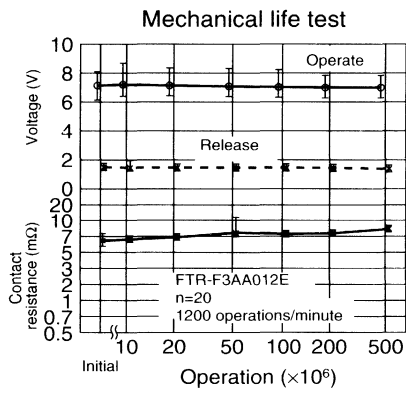
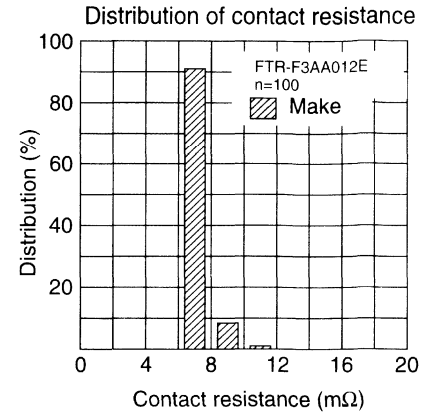
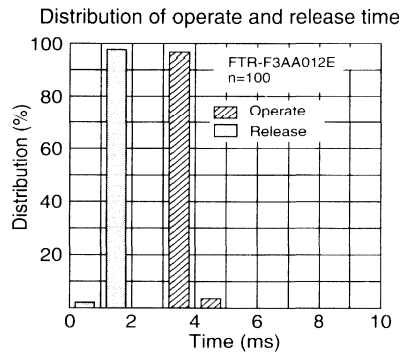
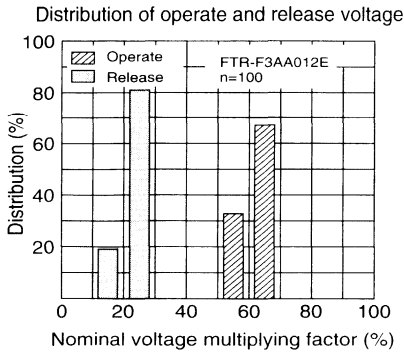
Note: All values in the table are measured at 20°C.

CHARACTERISTIC DATA



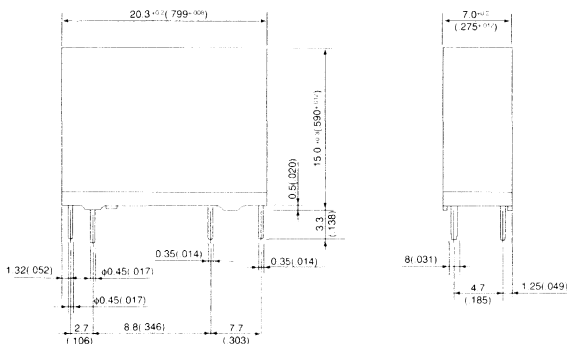
FTR-F3 Series

REFERENCE DATA

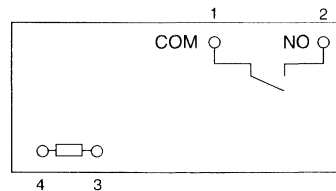


DIMENSIONS

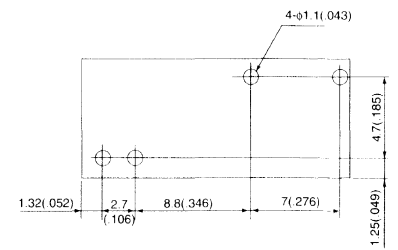
Dimensions



Schematics (BOTTOM VIEW)



PC board mounting hole layout (BOTTOM VIEW)

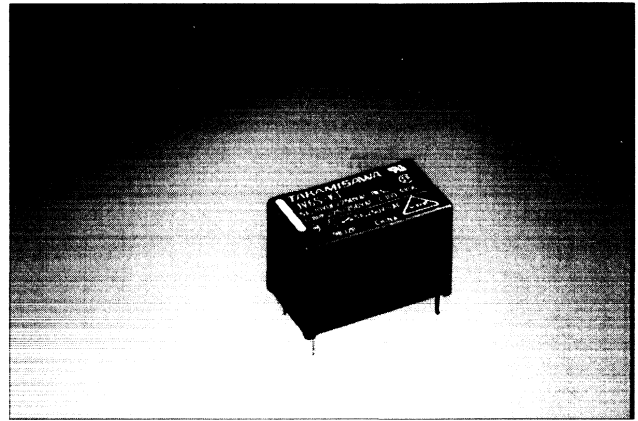


POWER RELAY

1 POLE—5 A (MEDIUM LOAD CONTROL) JV SERIES

■ FEATURES

- UL, CSA, VDE, SEMKO recognized
- UL class B (130°C) insulation
- Low profile and space saving
 - Height: 12.5 mm
 - Mounting space: 175 mm²
- High sensitivity in small package
 - Operating power: 0.112 to 0.13 W
 - Nominal power: 0.2 to 0.3 W
- High insulation with reinforced insulation system (between coil and contacts)
 - Insulation distance: 8 mm
 - Dielectric strength: 5,000 VAC
 - Surge strength: 10,000 V
- Plastic materials—UL94 flame class V-0
 - UL CTI level class 2
- Plastic sealed type backfilled with nitrogen
- Cadmium free contacts



■ ORDERING INFORMATION

[Example] $\frac{JV}{(a)}$ - $\frac{12}{(*)}$ $\frac{S}{(b)}$ - $\frac{K}{(c)}$ $\frac{T}{(d)}$ $\frac{T}{(e)}$

| | | |
|-----|-----------------|--|
| (a) | Series Name | JV : JV Series |
| (b) | Nominal Voltage | Refer to the COIL DATA CHART |
| (c) | Coil Type | Nil : Single type S : High sensitivity type |
| (d) | Enclosure | K : Plastic sealed type |
| (e) | Mounting | T : High density mounting type |

Note: Actual marking omits the hyphen (-) of (*)

JV SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL 508 (File No. E56140)
 C22.2 No. 14 (File No. LR35579)
 CSA certified to NRTL/C (class 3211-87)
 VDE0435, 0631, 0700

| Nominal voltage | Contact rating |
|-----------------|---|
| 3 to 24 VDC | 1/8 HP 125 VAC/250 VAC 5 A 30 VDC/250 VAC, resistive 2 A 250 VAC inductive (COS ϕ = 0.4) Pilot duty C 300 |

■ SPECIFICATIONS

| Item | | Standard Type JV-() | High Sensitivity Type JV-() S |
|-------------------------|------------------------------|---|---|
| Contact | Arrangement | 1 form A (SPST-NO) | |
| | Material | Silver alloy | |
| | Type | Single | |
| | Resistance (initial) | Maximum 70 m Ω (at 1 A 6 VDC) | |
| | Rating (resistive) | 5 A 250 VAC or 5 A 30 VDC | |
| | Maximum Carrying Current | 5 A | |
| | Maximum Switching Power | 1,250 VA, 150 W | |
| | Maximum Switching Voltage | 250 VAC, 150 VDC | |
| | Maximum Switching Current | 5 A | |
| | Minimum Switching Load*1 | 100 mA 5 VDC | |
| | Coil | Nominal Power (at 20°C) | 0.3 W |
| Operate Power (at 20°C) | | 0.13 W | 0.113 W |
| Operating Temperature | | -40°C~+70°C (no frost) (refer to the CHARACTERISTIC DATA) | |
| Time Value | Operate (at nominal voltage) | Maximum 8 ms | |
| | Release (at nominal voltage) | Maximum 4 ms | |
| Insulation | Resistance (500 VDC) | Minimum 1,000 M Ω | |
| | Dielectric Strength | between open contacts | 750 VAC 1 minute |
| | | between coil and contacts | 5,000 VAC 1 minute |
| | Surge Strength | 10,000 V (1.2 x 50 μ s (between coil and contacts)) | |
| Life | Mechanical | 5 x 10 ⁶ operations minimum | |
| | Electrical | 100 x 10 ³ operations minimum (contact rating) | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.65 mm) |
| | | Endurance | 10 to 55 Hz (double amplitude of 5.0 mm) |
| | Shock Resistance | Misoperation | 100 m/s ² (11 \pm 1 ms) |
| | | Endurance | 1,000 m/s ² (6 \pm 1 ms) |
| | Weight | Approximately 4.3 g | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

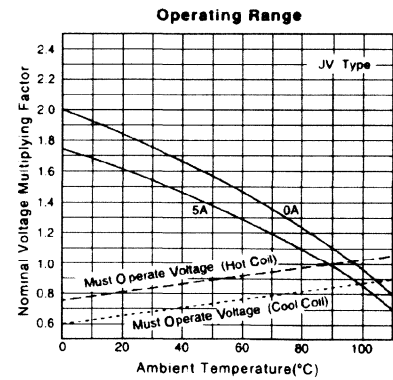
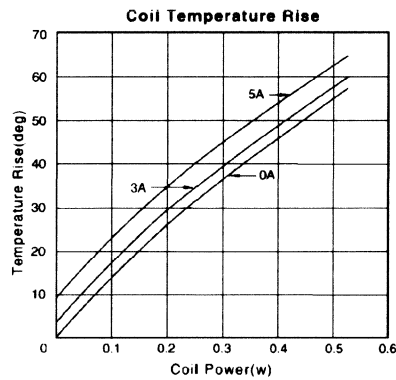
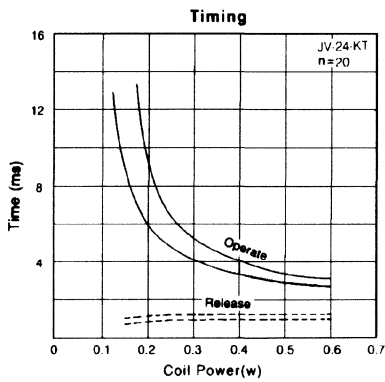
JV SERIES

COIL DATA CHART

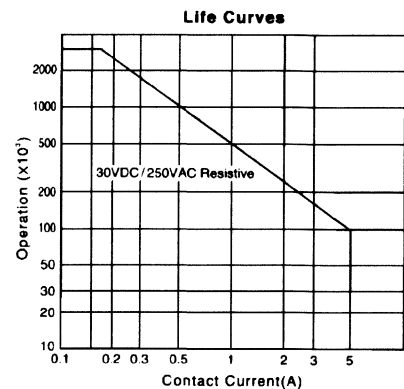
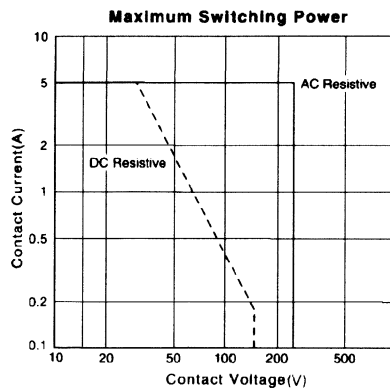
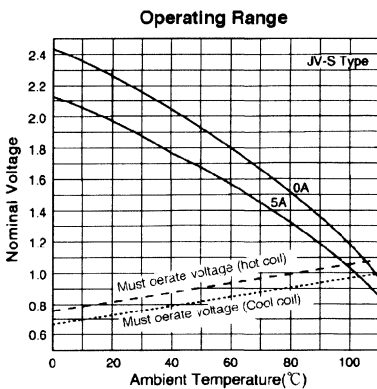
| | MODEL | Nominal voltage | Coil resistance ($\pm 10\%$) | Must operate voltage | Must release voltage | Nominal power |
|-----------------------|-----------|-----------------|--------------------------------|----------------------|----------------------|---------------|
| Standard Type | JV- 3-KT | 3 VDC | 30 Ω | +1.98 VDC | +0.15 VDC | 300 mW |
| | JV- 5-KT | 5 VDC | 83.3 Ω | +3.3 VDC | +0.25 VDC | 300 mW |
| | JV- 6-KT | 6 VDC | 120 Ω | +3.96 VDC | +0.3 VDC | 300 mW |
| | JV- 9-KT | 9 VDC | 270 Ω | +5.94 VDC | +0.45 VDC | 300 mW |
| | JV-12-KT | 12 VDC | 480 Ω | +7.9 VDC | +0.6 VDC | 300 mW |
| | JV-18-KT | 18 VDC | 1,080 Ω | +11.9 VDC | +0.9 VDC | 300 mW |
| | JV-24-KT | 24 VDC | 1,920 Ω | +15.8 VDC | +1.2 VDC | 300 mW |
| High Sensitivity Type | JV- 3S-KT | 3 VDC | 45 Ω | +2.25 VDC | +0.15 VDC | 200 mW |
| | JV- 5S-KT | 5 VDC | 125 Ω | +3.75 VDC | +0.25 VDC | 200 mW |
| | JV- 6S-KT | 6 VDC | 180 Ω | +4.5 VDC | +0.3 VDC | 200 mW |
| | JV- 9S-KT | 9 VDC | 405 Ω | +6.75 VDC | +0.45 VDC | 200 mW |
| | JV-12S-KT | 12 VDC | 720 Ω | +9.0 VDC | +0.6 VDC | 200 mW |
| | JV-18S-KT | 18 VDC | 1,620 Ω | +13.5 VDC | +0.9 VDC | 200 mW |
| | JV-24S-KT | 24 VDC | 2,880 Ω | +18.0 VDC | +1.2 VDC | 200 mW |

Note : All values in the table are measured at 20°C.

CHARACTERISTIC DATA

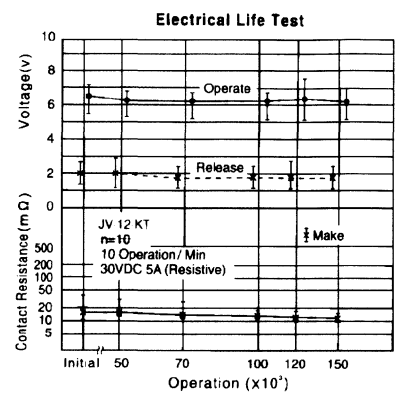
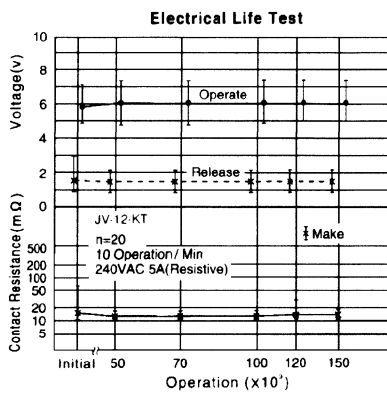
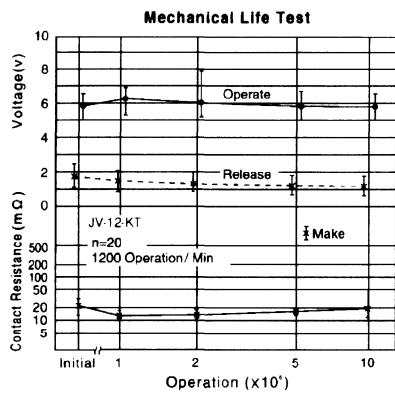
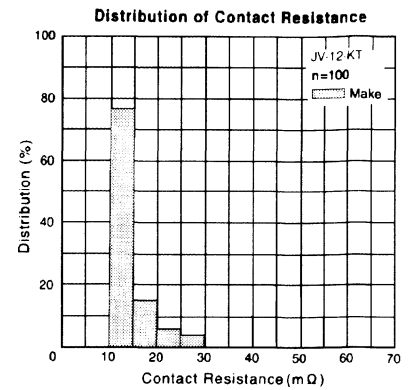
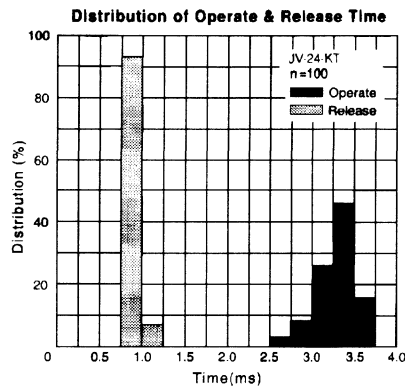
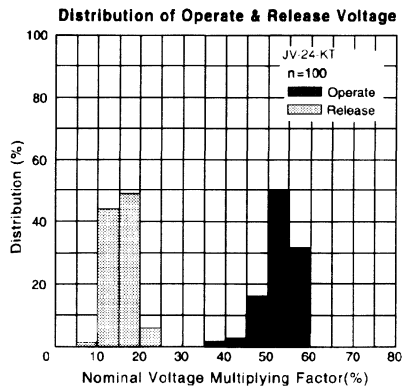


REFERENCE DATA



JV SERIES

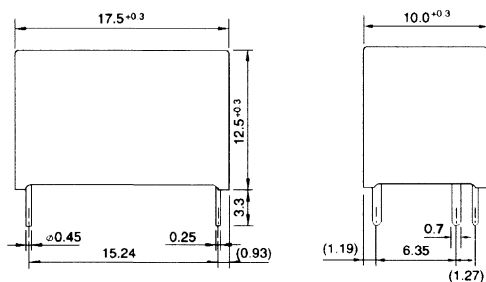
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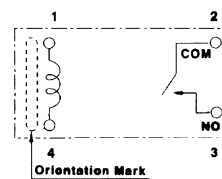
DIMENSIONS

● Dimensions

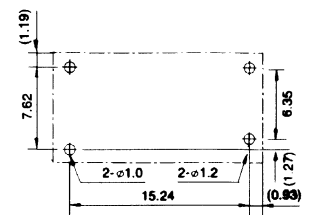
JV-KT type



● Schematics
(BOTTOM VIEW)



● PC board mounting
hole layout
(BOTTOM VIEW)



Unit: mm

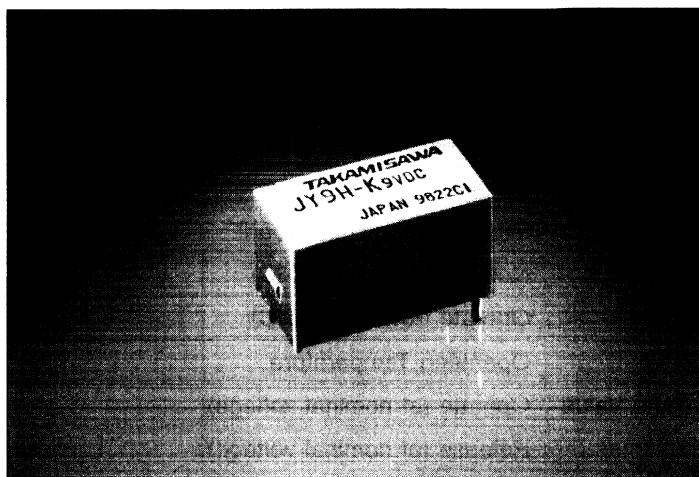
POWER RELAY

1 POLE—3, 5 A (MEDIUM LOAD CONTROL)

JY SERIES

■ FEATURES

- UL, CSA, VDE recognized
- High sensitivity and low power consumption
- High isolation
- Wide operating range
- DIL pitch terminals
- Plastic sealed type backfilled with nitrogen
- Socket mounting type and socket available
- Compatible with solid state relays type SJ (see page 347, 352) in size and pin (terminal) arrangement



■ ORDERING INFORMATION

[Example] JY - 12 H E - K P*2
 (a) (*) (b) (c) (d) (e) (f)

| | | |
|-----|-------------------------|---|
| (a) | Series Name | JY : JY Series |
| (b) | Nominal Voltage | Refer to the COIL DATA CHART |
| (c) | Contact Style | Nil : 3 A (Single contact) H : 5 A (Single contact) W : 3A (Bifurcated contact) |
| (d) | Contact Material | Nil : Gold-plate silver alloy (single type) Nil : Gold overlay silver alloy (bifurcated) E : Silver alloy (single type) |
| (e) | Enclosure | K : Plastic sealed type |
| (f) | Terminal Classification | Nil : PC board mounting type P : Socket mounting type (without JY-W) |

Note: 1. Actual marking omits the hyphen (-) of (*)
2. Actual marking omits the P of (*2)

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E56140) SEV (File No. 98.7 70498.02)

C22.2 No. 14 (File No. LR35579)

VDE0435

Please request when the approval markings are required on the cover and/or relay recognized by SEV is required.

| Type | Nominal voltage | Contact rating |
|----------------|-----------------|--|
| JY-H, JY-HE | 4.5 to 48 VDC | 1/8 HP 125 VAC/250 VAC 5 A 30 VDC/250 VAC, resistive Pilot duty C 150 |
| JY, JY-W, JY-E | 4.5 to 48 VDC | 1/10 HP 125 VAC/250 VAC 3 A 30 VDC/250 VAC, resistive Pilot duty D 150 |

JY SERIES

■ SPECIFICATIONS

| Item | | 3 A Type | | | 5 A Type | |
|----------------|--|---|--|---------------------------|-------------------------|--------------|
| | | JY-() W-K | JY-() -K | JY-() E-K | JY-() H-K | JY-() HE-K |
| Contact | Arrangement | 1 form A (SPST-NO) | | | | |
| | Material | Gold overlay silver alloy | Gold-plate silver alloy | Silver alloy | Gold-plate silver alloy | Silver alloy |
| | Style | Bifurcated | Single | | | |
| | Resistance (initial) (at 1A 6 VDC) | Maximum 30 mΩ | | Max. 100 mΩ | Max. 30 mΩ | Max. 100 mΩ |
| | Rating (resistive) | 3 A 250 VAC or 3 A 30 VDC | | 5 A 250 VAC or 5 A 30 VDC | | |
| | Maximum Carrying Current | 5 A | | | | |
| | Maximum Switching Power | 750 VA, 90 W | | | 1,250 VA, 150 W | |
| | Maximum Switching Voltage | 250 VAC, 150 VDC | | | | |
| | Maximum Switching Current | 3 A | | | 5 A | |
| | Minimum Switching Load* ¹ | 0.1 mA 100 mVDC | 10 mA 5 VDC | 100 mA 5 VDC | 10 mA 5 VDC | 100 mA 5 VDC |
| Coil | Nominal Power (at 20°C) | 0.2 W (48 V type: 0.36 W) | | | | |
| | Operate Power (at 20°C) | 0.1 W (48 V type: 0.17 W) | | | | |
| | Operating Temperature | -40°C to +90°C (no frost) (48V type: +80°C) | | | | |
| Time Value | Operate (at nominal voltage) | Maximum 6 ms | | | | |
| | Release (at nominal voltage) | Maximum 3 ms | | | | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | | | |
| | Dielectric | between open contacts | 750 VAC 1 minute | | | |
| | | between coil and contacts | Standard type 2,000 VAC 1 minute High dielectric strength type 3,000 VAC 1 minute | | | |
| Surge Strength | Standard type 4,000 V (at 1.2 x 50 μs) High dielectric strength type 5,000 V (at 1.2 x 50 μs) | | | | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | | | |
| | Electrical | 100 x 10 ³ operations minimum (contact rating) | | | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) | | | |
| | | Endurance | 10 to 55 Hz (double amplitude of 4.5 mm) | | | |
| | Shock Resistance | Misoperation | 100 m/s ² (11±1 ms) | | | |
| | | Endurance | 1,000 m/s ² (6±1 ms) | | | |
| | Weight | Approximately 5 g | | | | |

*¹ Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

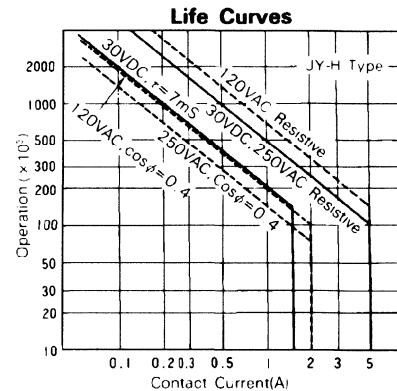
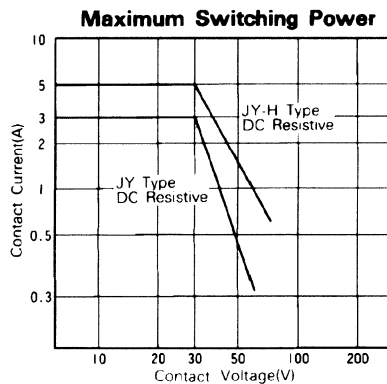
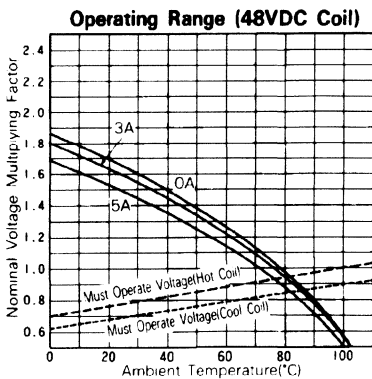
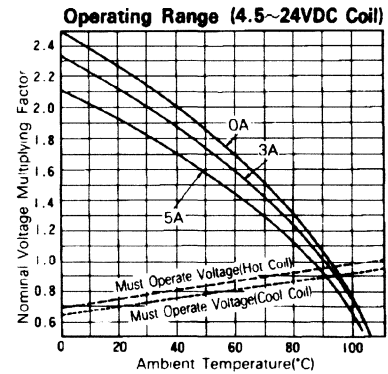
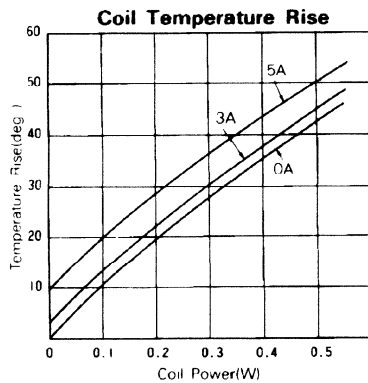
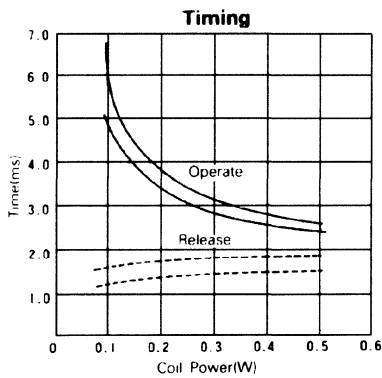
JY SERIES

COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance (±10%) | Must operate voltage*1 | Must release voltage*1 | Nominal power |
|---------------------|----------------------------|-----------------|------------------------|------------------------|------------------------|---------------|
| 5 A Type | 3 A Type | | | | | |
| JY-() H, JY-() HE | JY-(), JY-() W, JY-() E | | | | | |
| JY- 4.5 H ()-K | JY- 4.5 ()-K | 4.5 VDC | 100 Ω | 3.1 VDC | 0.23 VDC | 200 mW |
| JY- 5 H ()-K | JY- 5 ()-K | 5 VDC | 125 Ω | 3.5 VDC | 0.25 VDC | 200 mW |
| JY- 6 H ()-K | JY- 6 ()-K | 6 VDC | 180 Ω | 4.2 VDC | 0.3 VDC | 200 mW |
| JY- 9 H ()-K | JY- 9 ()-K | 9 VDC | 405 Ω | 6.3 VDC | 0.45 VDC | 200 mW |
| JY- 12 H ()-K | JY- 12 ()-K | 12 VDC | 720 Ω | 8.4 VDC | 0.6 VDC | 200 mW |
| JY- 18 H ()-K | JY- 18 ()-K | 18 VDC | 1,620 Ω | 12.6 VDC | 0.9 VDC | 200 mW |
| JY- 24 H ()-K | JY- 24 ()-K | 24 VDC | 2,880 Ω | 16.8 VDC | 1.2 VDC | 200 mW |
| JY- 48 H ()-K | JY- 48 ()-K | 48 VDC | 6,400 Ω | 32.6 VDC | 2.4 VDC | 360 mW |
| JY-101-K | | 23.5 VDC | 2,760 Ω | 15.5 VDC | 1.18 VDC | 200 mW |
| JY-105-K | | 12 VDC | 720 Ω | 8.4 VDC | 0.6 VDC | 200 mW |
| JY-107-K | | 5 VDC | 125 Ω | 3.5 VDC | 0.25 VDC | 200 mW |

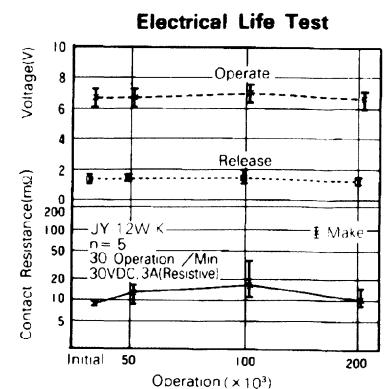
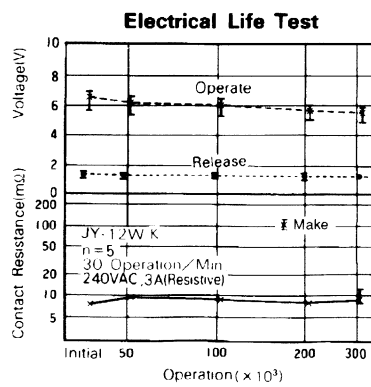
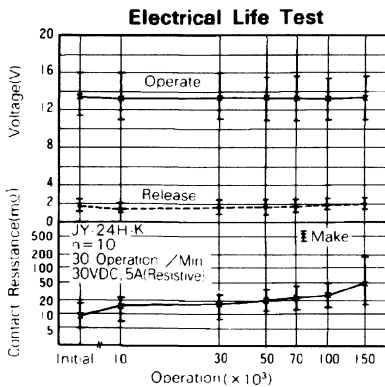
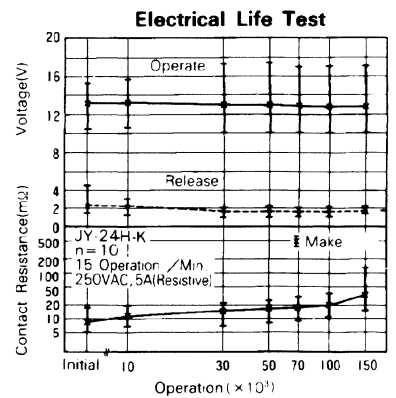
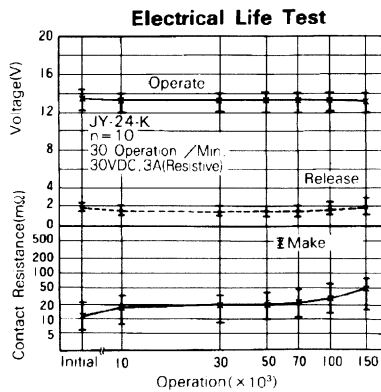
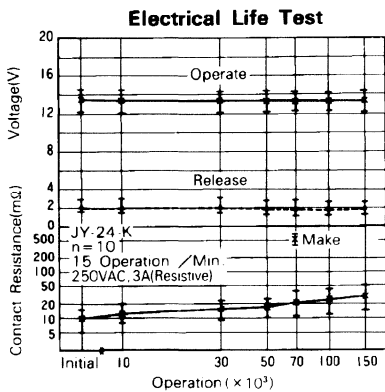
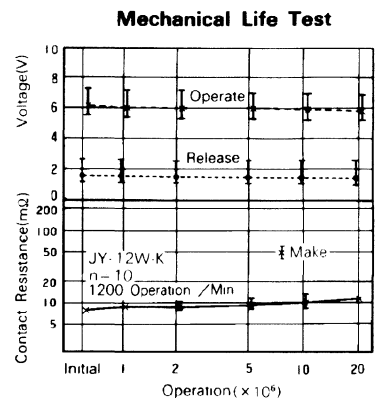
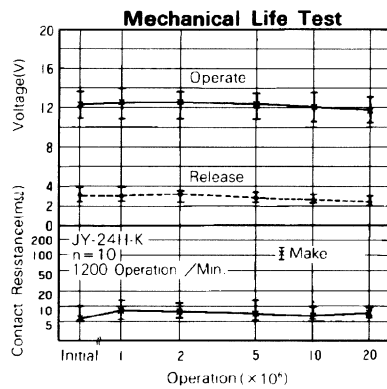
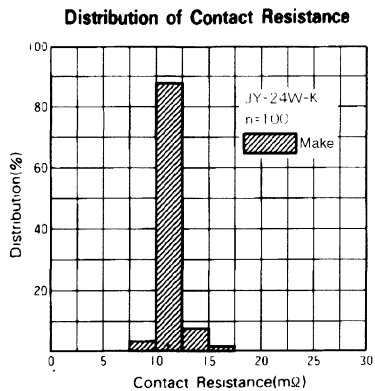
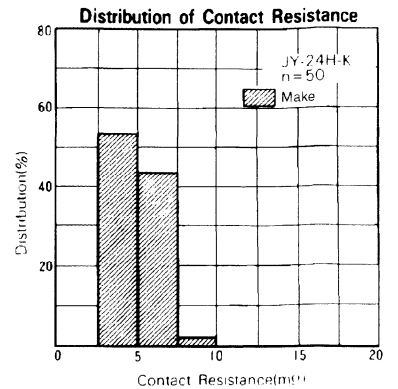
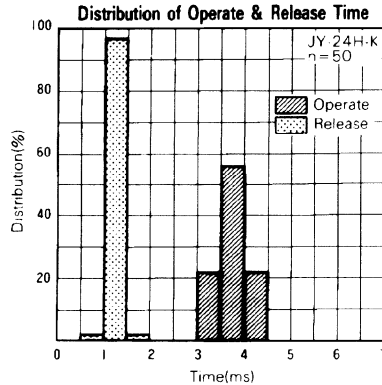
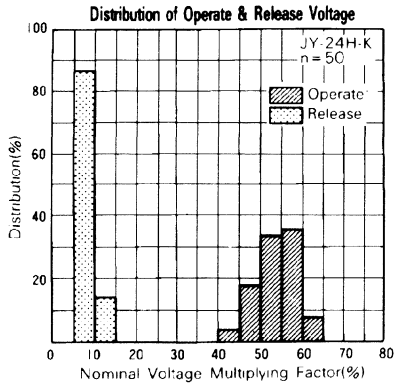
Note: *1 Specified values are subject to pulse wave voltage.
All values in the table are measured at 20°C.

CHARACTERISTIC DATA

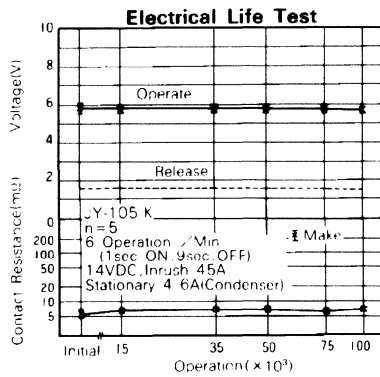


JY SERIES

REFERENCE DATA



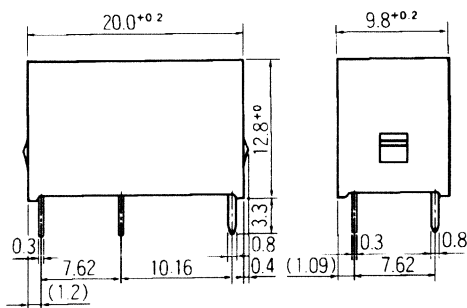
JY SERIES



■ DIMENSIONS

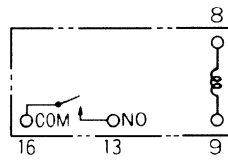
● Dimensions

JY Type



● Schematics

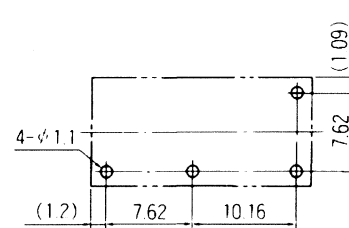
(BOTTOM VIEW)



● PC board mounting

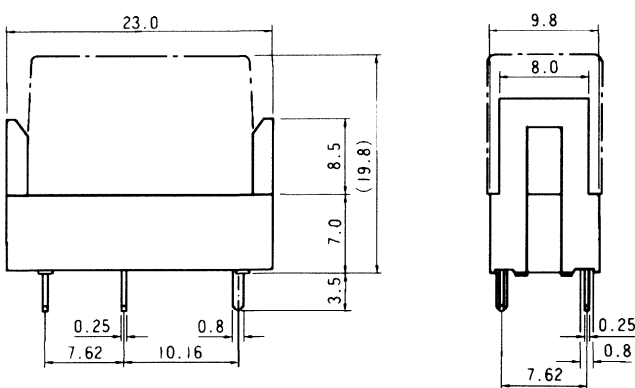
hole layout

(BOTTOM VIEW)



Unit: mm

■ SOCKET DIMENSIONS



Unit: mm

■ NOTES

1. Socket ordering code : JK-4N
2. Standard IC socket is not recommended.
Please use socket "JK-4N".

JY SERIES

NOTES

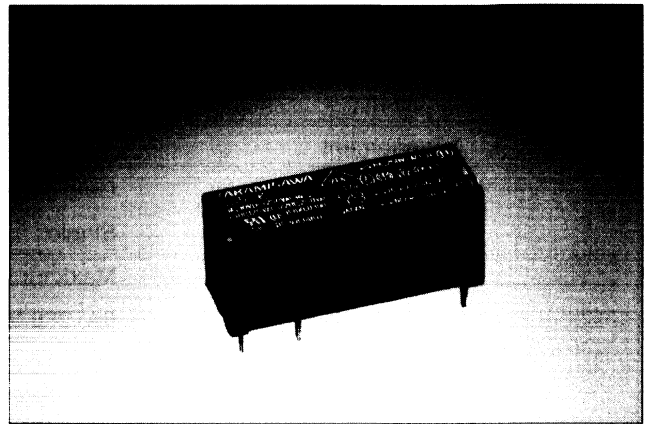


POWER RELAY

1 POLE—8 A (MEDIUM LOAD CONTROL) JS SERIES

■ FEATURES

- UL, CSA, VDE, SEV, SEMKO, FIMKO, ÖVE, BSI recognized
- UL class B (130°C) insulation
- 1 form A (SPST-NO) or 1 form C (SPDT) contact
- Low profile and space saving—Height: 12.5 mm
—Mounting space: 290 mm²
- High sensitivity in small package
—Operating power 0.11 to 0.14 W
—Nominal power 0.22 to 0.29 W
- High isolation in small package
—Insulation distance : 8 mm
—Dielectric strength : 5,000 VAC (between coil and contacts)
—Surge strength : 10,000 V
- Plastic materials—UL 94 flame class V-0
—UL CTI level class 2
- Plastic sealed type backfilled with nitrogen



■ ORDERING INFORMATION

[Example] JS - 12 M E - K T
 (a) (*) (b) (c) (d) (e) (f)

| | | |
|-----|---------------------|--|
| (a) | Series Name | JS : JS Series |
| (b) | Nominal Voltage | Refer to the COIL DATA CHART |
| (c) | Contact Arrangement | Nil : 1 form C (SPDT) M : 1 form A (SPST-NO) |
| (d) | Contact Material | Nil : Gold plate silver alloy E : Silver alloy N : Silver tin oxide gold overlay |
| (e) | Enclosure | K : Plastic sealed type |
| (f) | Construction | Nil: 3.2 mm T : 5.0 mm (only 1 form A) |

Note: Actual marking omits the hyphen (-) of (*)

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E56140, E108658)

SEV (File No. 98.7 70498.01)

C22.2 No. 14 (File No. LR35579)

VDE0435, 0631, 0700

| Nominal voltage | Contact rating |
|-----------------|--|
| 5 to 60 VDC | 1/3 HP 125 VAC, 1/2 HP 250 VAC 10 A 30 VDC/250 VAC, resistive 3A 250 VAC inductive Pilot duty B 300, C150, Q300 |

■ SPECIFICATIONS

| Item | | JS | |
|----------------|--------------------------------------|---|---|
| Contact | Arrangement | 1 form A (SPST-NO), 1 form C (SPDT) | |
| | Material | Gold plate silver alloy / silver alloy | |
| | Style | Single | |
| | Resistance (initial) | Maximum 30 mΩ /JS-E type: maximum 100 mΩ (at 1 A 6 VDC) | |
| | Rating (resistive) | 8A 250 VAC or 8A 24 VDC | |
| | Maximum Carrying Current | 10 A | |
| | Maximum Switching Power | 2,000 VA, 192 W | |
| | Maximum Switching Voltage | 400VAC, 150 VDC | |
| | Maximum Switching Current | 10 A | |
| | Minimum Switching Load* ¹ | 10 mA 5 VDC/100 mA 5 VDC | |
| Coil | Nominal Power (at 20°C) | 0.22 to 0.29 W | |
| | Operate Power (at 20°C) | 0.11 to 0.14 W | |
| | Operating Temperature | -40°C to +85°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute |
| | | between coil and contacts | 5,000 VAC 1 minute |
| Surge Strength | 10,000 V (at 1.2 x 50 μs) | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | |
| | Electrical | 100 x 10 ³ operations minimum (nominal load) | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.65 mm) |
| | | Endurance | 10 to 55 Hz (double amplitude of 3.3 mm) |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ±1 ms) |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) |
| Weight | Approximately 8 g | | |

*¹ Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

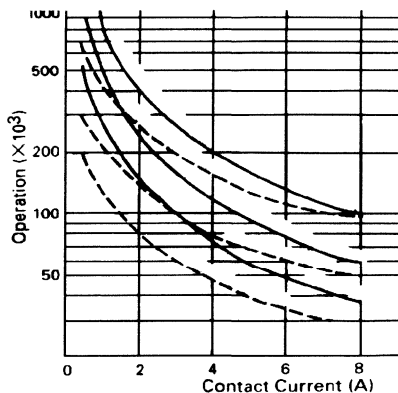
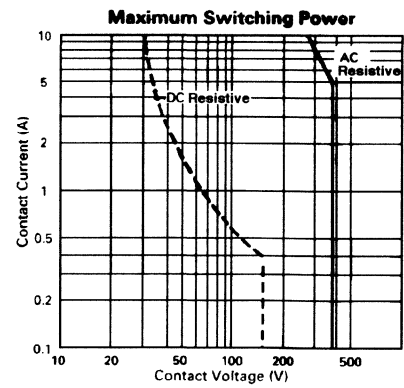
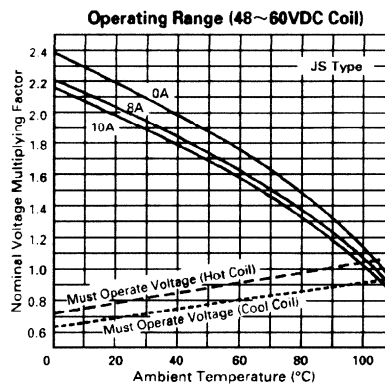
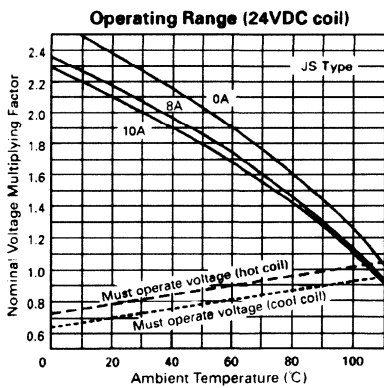
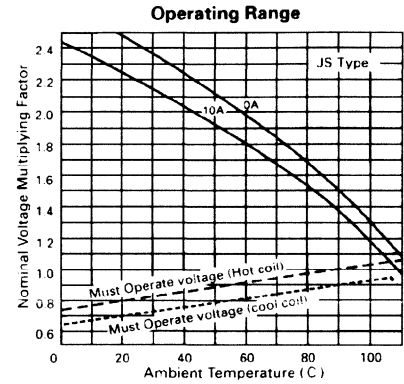
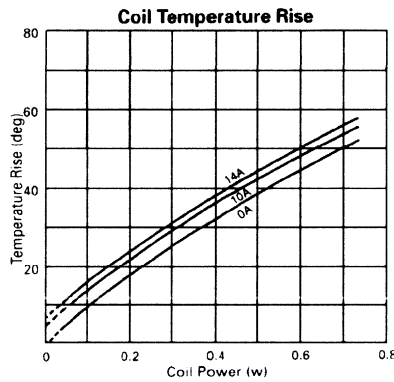
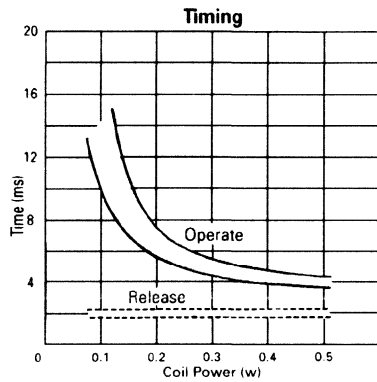
JS SERIES

COIL DATA CHART

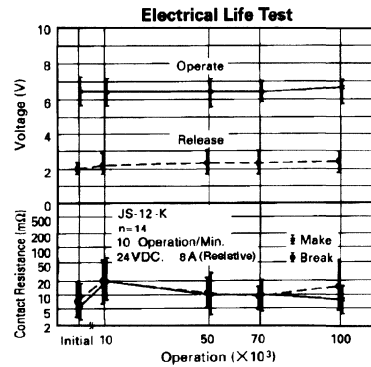
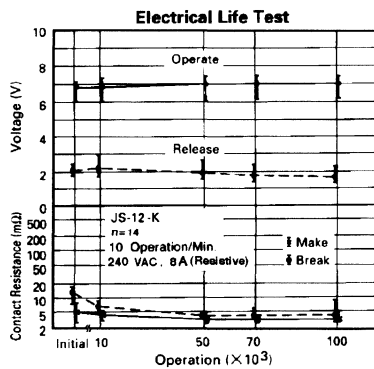
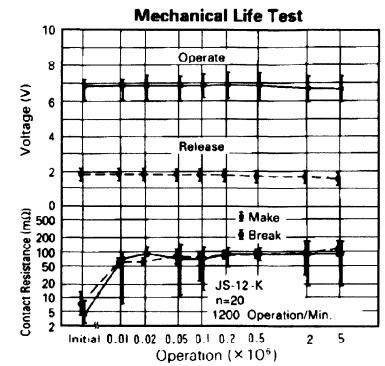
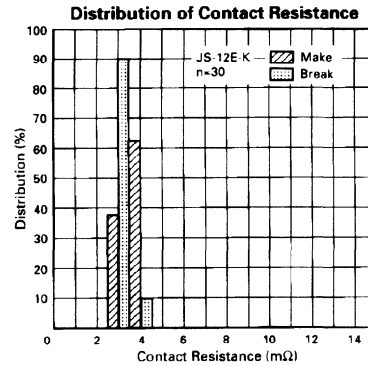
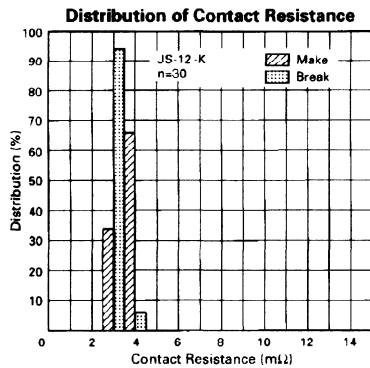
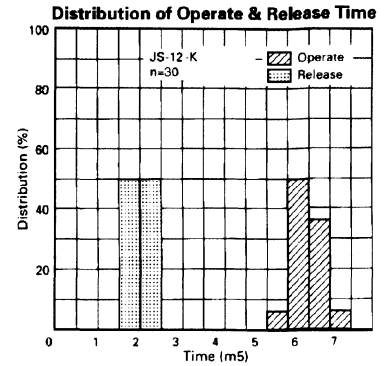
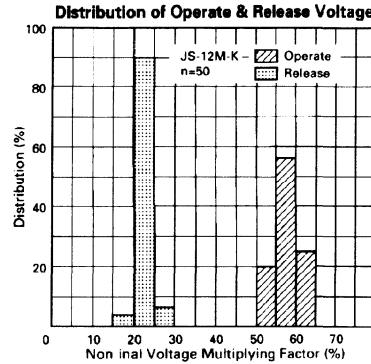
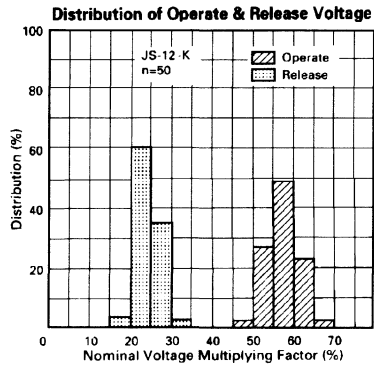
| MODEL | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage | Nominal power |
|----------------------|-----------------|------------------------|----------------------|----------------------|---------------|
| JS- 5 (M) (E) -K (T) | 5 VDC | 112 Ω | 3.5 VDC | 0.5 VDC | 225 mW |
| JS- 6 (M) (E) -K (T) | 6 VDC | 160 Ω | 4.2 VDC | 0.6 VDC | 225 mW |
| JS- 9 (M) (E) -K (T) | 9 VDC | 360 Ω | 6.3 VDC | 0.9 VDC | 225 mW |
| JS-12 (M) (E) -K (T) | 12 VDC | 660 Ω | 8.5 VDC | 1.2 VDC | 220 mW |
| JS-18 (M) (E) -K (T) | 18 VDC | 1,455 Ω | 12.7 VDC | 1.8 VDC | 225 mW |
| JS-24 (M) (E) -K (T) | 24 VDC | 2,350 Ω | 16.8 VDC | 2.4 VDC | 245 mW |
| JS-48 (M) (E) -K (T) | 48 VDC | 8,000 Ω | 33.4 VDC | 4.8 VDC | 290 mW |
| JS-60 (M) (E) -K (T) | 60 VDC | 12,500 Ω | 41.7 VDC | 6.0 VDC | 290 mW |

Note : All values in the table are measured at 20°C.

CHARACTERISTIC DATA



REFERENCE DATA

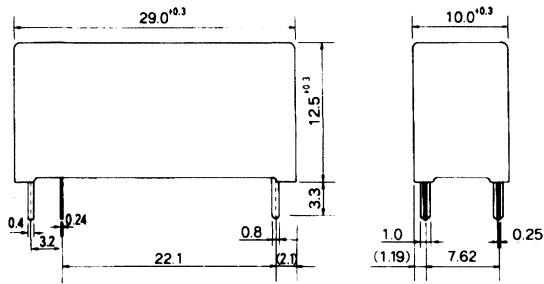


JS SERIES

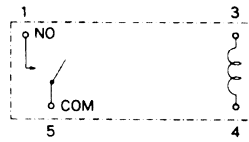
■ DIMENSIONS

● Dimensions

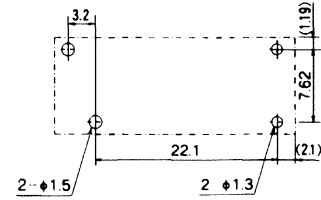
JS-M type



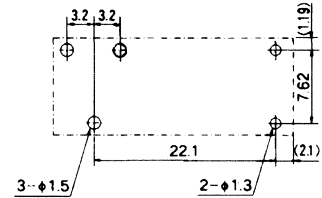
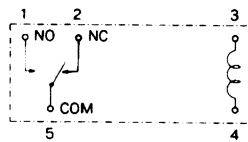
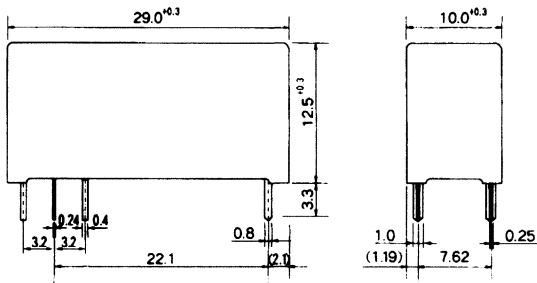
● Schematics (BOTTOM VIEW)



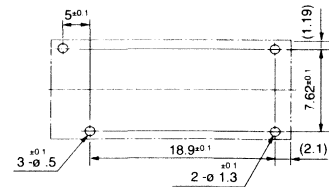
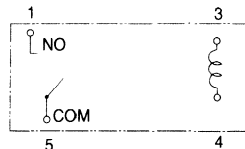
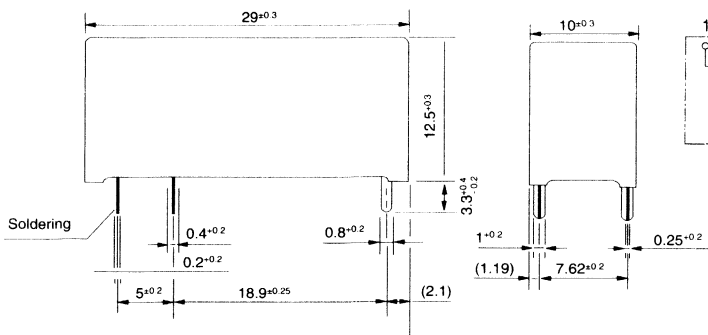
● PC board mounting hole layout (BOTTOM VIEW)



JS type



JS-MT type



Unit: mm

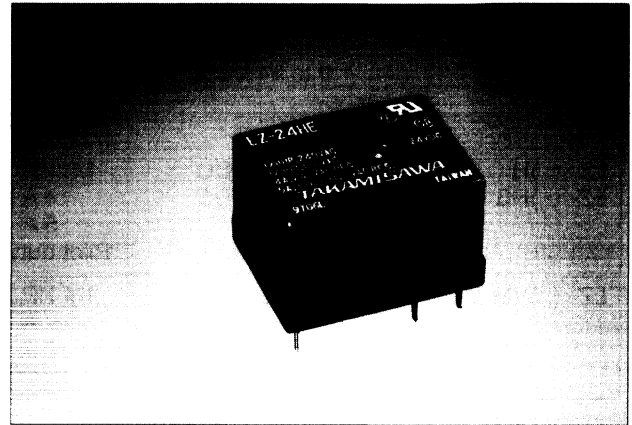
NOTES

POWER RELAY

1 POLE—1, 3, 5, 10 A (MEDIUM LOAD CONTROL) LZ SERIES

■ FEATURES

- UL, CSA
- 4 kinds of contact ratings
—Low level to 10 amps switching
- Standard and high sensitivity types available
- High surge strength version available
- UL class B (130°C) insulation type available (only plastic sealed type)
- Printed circuit terminals—fits grid with 0.1 inch
- Plastic sealed type backfilled with nitrogen available



■ ORDERING INFORMATION

[Example] LZ - B 12 H M S E - K HV - UC
 (a) (b) (c) (d) (e) (f) (g) (h) (i) (j)

| | | |
|-----|---------------------------|---|
| (a) | Series Name | LZ : LZ Series |
| (b) | Coil Heat Proof Class | Nil : Standard type B : UL class B insulation type (130°C) |
| (c) | Nominal Voltage | Refer to the COIL DATA CHART |
| (d) | Contact Rating | Nil : 3 A H : 5 A V : 10 A (only LZ-M) W : 1 A (bifurcated) |
| (e) | Contact Arrangement | Nil : 1 form C (SPDT) M : 1 form A (SPST-NO) |
| (f) | Coil Type | Nil : Standard type S : High sensitive type |
| (g) | Contact Material (Rating) | Nil : Gold overlay silver-palladium (only LZ-W) Nil : Gold overlay silver-nickel (3 A, 5 A) Nil : Silver alloy (10 A) (only LZ-V) E : Silver-nickel (3 A, 5 A) |
| (h) | Enclosure | Nil : Flux free type K : Plastic sealed type (recommended for new designs) C : Plastic sealed type (with tape) |
| (i) | Surge Strength | Nil : Standard type (4,000 V) HV : High dielectric strength type (6,000 V) |
| (j) | Standard | UC: UL, CSA approved type |

LZ SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E56140, E45026)

C22.2 No. 0, No. 14 (File No. LR35579)

SEV (File No. 98.7 70497.01)

Please note that UL/CSA ratings may differ from the standard ratings.

Please request when the approval markings are required on the cover and/or relay recognized by SEV is required.

| Type | Nominal voltage | Contact rating |
|-----------------------|--------------------------------|--|
| LZ- ()W LZ- ()WS | 1.5 to 48 VDC 1.5 to 24 VDC | 0.8 A 240 VAC resistive 1 A 30 VDC/120 VAC resistive |
| LZ- () LZ- ()S | 1.5 to 48 VDC 1.5 to 24 VDC | 1/10 HP 120 VAC/240 VAC 2.5 A 240 VAC resistive 3 A 30 VDC/120 VAC resistive Pilot duty D 150 |
| LZ- ()H LZ- ()HS | 1.5 to 48 VDC 1.5 to 24 VDC | 1/8 HP 120 VAC/240 VAC 4 A 240 VAC resistive 5 A 30 VDC/120 VAC resistive Pilot duty C 150 |
| LZ- ()VM | 1.5 to 48 VDC | 1/4 HP 120 VAC/240 VAC 7 A 240 VAC resistive 10 A 24 VDC/120 VAC resistive Pilot duty C 150 |

LZ SERIES

■ SPECIFICATIONS

LZ-()Type (Standard Type)

| Item | | 10 A Type | 5 A Type | 3 A Type | 1 A Type |
|----------------|--|--|--|--|-------------------------------|
| | | LZ-()VM | LZ-()H, LZ-()HE | LZ(), LZ-()E | LZ-()W |
| Contact | Arrangement | 1 form A (SPST-NO) | 1 form C (SPDT) or 1 form A (SPST - NO) | | |
| | Material | Silver alloy | Gold overlay silver alloy Silver alloy (LZ-HE, E) | | Gold overlay silver-palladium |
| | Style | Single | | | Bifurcated |
| | Resistance (initial) (at 1 A 6VDC) | Maximum 100 mΩ | Maximum 70 mΩ (LZ-H,LZ) Maximum 100 mΩ (LZ-HE, E) | | Maximum 50 mΩ |
| | Rating (resistive) | 10 A 120 VAC/24 VDC 1/4 H 120 VAC | 5 A 120 VAC/24 VDC 1/8 H 120 VAC | 3 A 120 VAC/30 VDC 1/10 H 120 VAC | 1 A 120 VAC/30 VDC |
| | Maximum Carrying Current | 10 A | 5 A | | 1 A |
| | Maximum Switching Power | 1,680 VA, 240 W | 960 VA, 120 W | 600 VA, 90 W | 190 VA, 30 W |
| | Maximum Switching Voltage | 250 VAC, 150 VDC | | | |
| | Maximum Switching Current | 10 A | 5 A | 3 A | 1 A |
| | Minimum Switching Load*1 | 100 mA 5 VDC | 10 mA 5 VDC (LZ-H) 100 mA 5 VDC (LZ-HE) | 10 mA 5 VDC (LZ-) 100 mA 5 VDC (LZ-E) | 0.1 mA 100 VDC |
| Coil | Nominal Power (at 20°C) | 0.45 to 0.60 W | | | |
| | Operate Power (at 20°C) | 0.17 to 0.22 W | | | |
| | Operating Temperature | -30°C to +70°C (no frost) (refer to the CHARACTERISTIC DATA) | | | |
| Time Value | Operate (at nominal voltage) | Maximum 7 ms | | | |
| | Release (at nominal voltage) | Maximum 4 ms | | | |
| Insulation | Resistance (at 500 VDC) | Minimum 250 MΩ | | | |
| | Dielectric Strength | between open contacts | 750 VAC 1 minute | | |
| | | between coil and contacts | 2,000 VAC 1 minute | | |
| Surge Strength | Standard type: 4,000 V (at 1.2 x 50 μs) High dielectric strength Type: 6,000 V (at 1.2 x 50 μs) | | | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | | |
| | Electrical | 100 x 10 ³ operations minimum (contact rating) | | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 3.3 mm) | | |
| | | Endurance | 10 to 55 Hz (double amplitude of 3.3 mm) | | |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ±1 ms) | | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | | |
| | Weight | Approximately 7.7 g | | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

LZ SERIES

■ SPECIFICATIONS

LZ-() S Type (High Sensitive Type)

| Item | | 5 A Type | 3 A Type | 1 A Type | |
|----------------|---|--|--|---|--------------------|
| | | LZ-()HS, LZ()HSE | LZ-()S, LZ-()SE | LZ-()WS | |
| Contact | Arrangement | 1 form A (SPST-NO) or 1 form C (SPDT) | | | |
| | Material | Gold overlay silver alloy (single type) | | Gold overlay silver-palladium (bifurcated type) | |
| | Resistance (initial) (at 1 A 6 VDC) | Maximum 70 mΩ (LZ-HS, S) Maximum 100 mΩ (LZ-HSE, SE) | | Maximum 50 mΩ | |
| | Rating | Resistive | 5 A 120 VAC/24 VDC | 3 A 120 VAC/24 VDC | 1 A 120 VAC/24 VDC |
| | | Motor Load | 1/8 H 120 VAC | 1/10 H 120 VAC | |
| | Maximum Carrying Current | 5 A | | 1 A | |
| | Maximum Switching Power | 960 VA, 120 W | 600 VA, 90 W | 190 VA, 30 W | |
| | Maximum Switching Voltage | 250 VAC, 150 VDC | | | |
| | Maximum Switching Current | 5 A | 3 A | 1 A | |
| | Minimum Switching Load*1 | 10 mA 5 VDC (LZ-HS, S) 100 mA 5 VDC (LZ-HSE, SE) | | 0.1 mA 100 mVDC | |
| Coil | Nominal Power (at 20°C) | 0.33 W | | | |
| | Operate Power (at 20°C) | 0.14 W | | | |
| | Operating Temperature | -30°C to +80°C (no frost) (refer to the CHARACTERISTIC DATA) | | | |
| Time Value | Operate (at nominal voltage) | Maximum 7 ms | | | |
| | Release (at nominal voltage) | Maximum 4 ms | | | |
| Insulation | Resistance | Minimum 250 MΩ | | | |
| | Dielectric Strength | between open contacts | 750 VAC 1 minute | | |
| | | between coil and contacts | 2,000 VAC 1 minute | | |
| Surge Strength | Standard type : 4,000 V (at 1.2 x 50μs) High dielectric strength type: 6,000 V (at 1.2 x 50μs) | | | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | | |
| | Electrical | 100 x 10 ³ operations minimum (rated load) | | | |
| Other | Vibration | Misoperation | 10 to 55 Hz (double amplitude of 3.3 mm) | | |
| | | Endurance | 10 to 55 Hz (double amplitude of 3.3 mm) | | |
| | Shock | Misoperation | 100 m/s ² (11 ±1 ms) | | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | | |
| | Weight | Approximately 7.7 g | | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

LZ SERIES

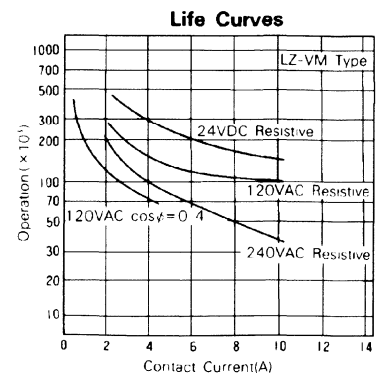
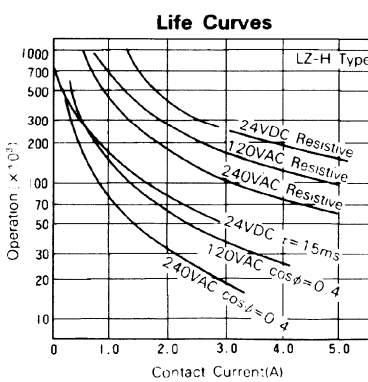
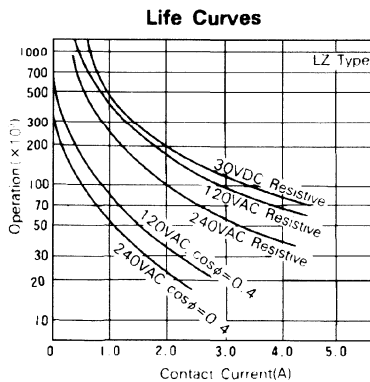
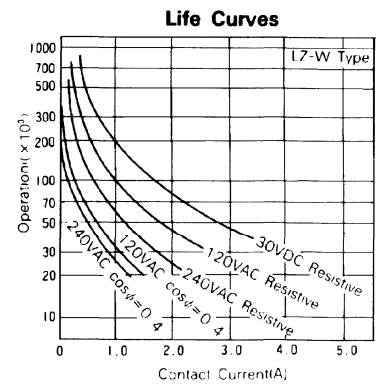
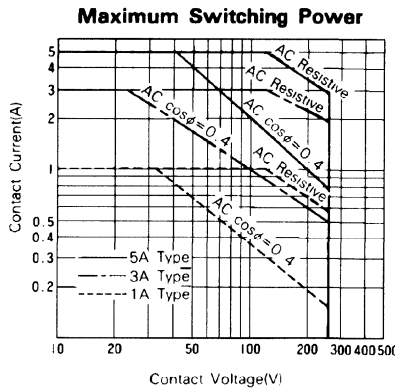
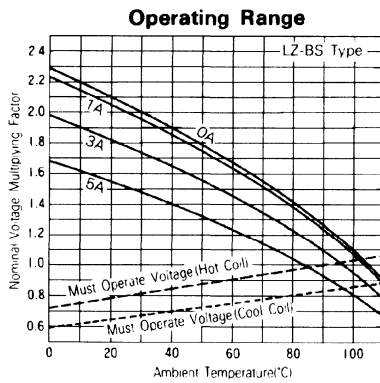
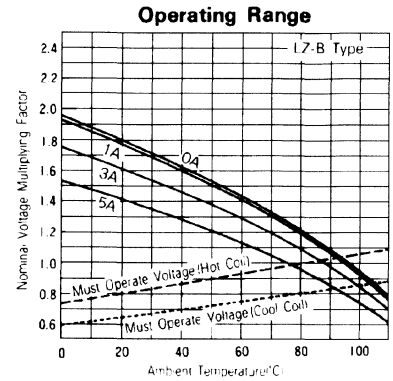
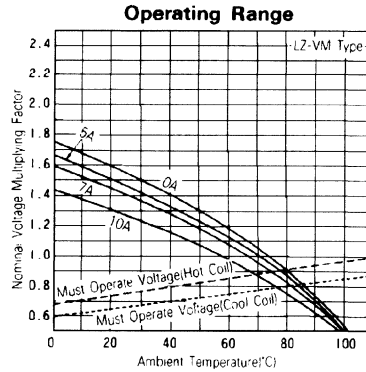
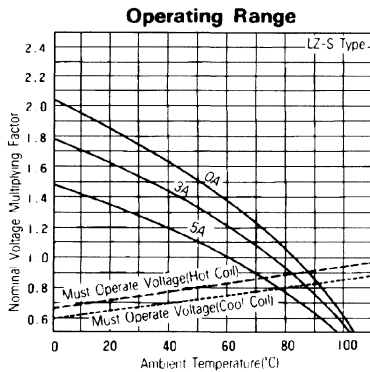
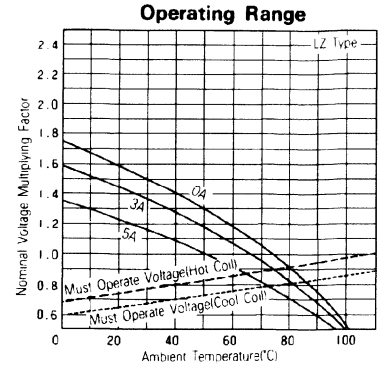
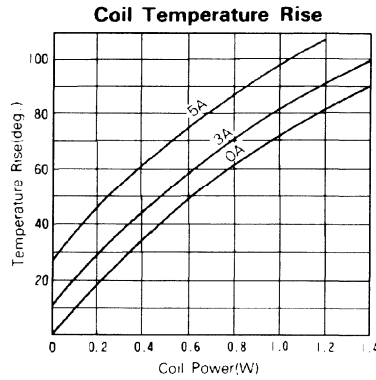
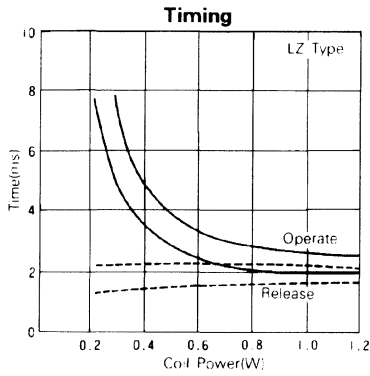
■ COIL DATA CHART

| | MODEL | | | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage | Nominal power |
|---------------------|------------------------|----------------------|--------------------|------------------|-----------------|------------------------|----------------------|----------------------|---------------|
| | Single | | | Bifurcated | | | | | |
| | 10 A Type | 5 A Type | 3 A Type | 1 A Type | | | | | |
| Standard Type | LZ-(B) 1.5 VM | LZ-(B) 1.5 H (M) (E) | LZ-(B) 1.5 (M) (E) | LZ-(B) 1.5 W (M) | 1.5 VDC | 5 Ω | 0.97 VDC | 0.08 VDC | 450 mW |
| | LZ-(B) 3 VM | LZ-(B) 3 H (M) (E) | LZ-(B) 3 (M) (E) | LZ-(B) 3 W (M) | 3 VDC | 20 Ω | 1.95 VDC | 0.15 VDC | 450 mW |
| | LZ-(B) 5 VM | LZ-(B) 5 H (M) (E) | LZ-(B) 5 (M) (E) | LZ-(B) 5 W (M) | 5 VDC | 56 Ω | 3.25 VDC | 0.25 VDC | 450 mW |
| | LZ-(B) 6 VM | LZ-(B) 6 H (M) (E) | LZ-(B) 6 (M) (E) | LZ-(B) 6 W (M) | 6 VDC | 80 Ω | 3.9 VDC | 0.3 VDC | 450 mW |
| | LZ-(B) 9 VM | LZ-(B) 9 H (M) (E) | LZ-(B) 9 (M) (E) | LZ-(B) 9 W (M) | 9 VDC | 180 Ω | 5.85 VDC | 0.45 VDC | 450 mW |
| | LZ-(B) 12 VM | LZ-(B) 12 H (M) (E) | LZ-(B) 12 (M) (E) | LZ-(B) 12 W (M) | 12 VDC | 320 Ω | 7.8 VDC | 0.6 VDC | 450 mW |
| | LZ-(B) 18 VM | LZ-(B) 18 H (M) (E) | LZ-(B) 18 (M) (E) | LZ-(B) 18 W (M) | 18 VDC | 720 Ω | 11.7 VDC | 0.9 VDC | 450 mW |
| | LZ-(B) 24 VM | LZ-(B) 24 H (M) (E) | LZ-(B) 24 (M) (E) | LZ-(B) 24 W (M) | 24 VDC | 1,280 Ω | 15.6 VDC | 1.2 VDC | 450 mW |
| | LZ-(B) 48 VM | LZ-(B) 48 H (M) (E) | LZ-(B) 48 (M) (E) | LZ-(B) 48 W (M) | 48 VDC | 3,800 Ω | 28.8 VDC | 2.4 VDC | 600 mW |
| | LZ-(B) 100 VM | LZ-(B) 100 H (M) (E) | LZ-(B) 100 (M) (E) | LZ-(B) 100 W (M) | 100 VDC | 22,200 Ω | 65.0 VDC | 5.0 VDC | 450 mW |
| High Sensitive Type | LZ-(B) 1.5 H (M) S (E) | LZ-(B) 1.5 (M) S (E) | LZ-(B) 1.5 W (M) S | 1.5 VDC | 6.8 Ω | 0.97 VDC | 0.08 VDC | 330 mW | |
| | LZ-(B) 3 H (M) S (E) | LZ-(B) 3 (M) S (E) | LZ-(B) 3 W (M) S | 3 VDC | 27 Ω | 1.95 VDC | 0.15 VDC | 330 mW | |
| | LZ-(B) 5 H (M) S (E) | LZ-(B) 5 (M) S (E) | LZ-(B) 5 W (M) S | 5 VDC | 80 Ω | 3.25 VDC | 0.25 VDC | 330 mW | |
| | LZ-(B) 6 H (M) S (E) | LZ-(B) 6 (M) S (E) | LZ-(B) 6 W (M) S | 6 VDC | 110 Ω | 3.9 VDC | 0.3 VDC | 330 mW | |
| | LZ-(B) 9 H (M) S (E) | LZ-(B) 9 (M) S (E) | LZ-(B) 9 W (M) S | 9 VDC | 250 Ω | 5.85 VDC | 0.45 VDC | 330 mW | |
| | LZ-(B) 12 H (M) S (E) | LZ-(B) 12 (M) S (E) | LZ-(B) 12 W (M) S | 12 VDC | 440 Ω | 7.8 VDC | 0.6 VDC | 330 mW | |
| | LZ-(B) 18 H (M) S (E) | LZ-(B) 18 (M) S (E) | LZ-(B) 18 W (M) S | 18 VDC | 990 Ω | 11.7 VDC | 0.9 VDC | 330 mW | |
| | LZ-(B) 24 H (M) S (E) | LZ-(B) 24 (M) S (E) | LZ-(B) 24 W (M) S | 24 VDC | 1,780 Ω | 15.6 VDC | 1.2 VDC | 330 mW | |

Note : All values in the table are measured at 20°C.

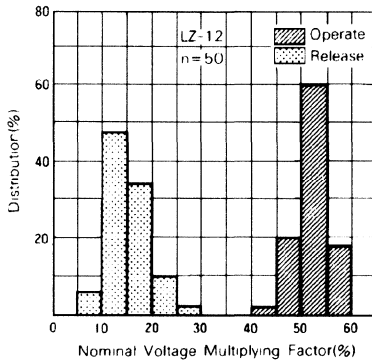
LZ SERIES

CHARACTERISTIC DATA

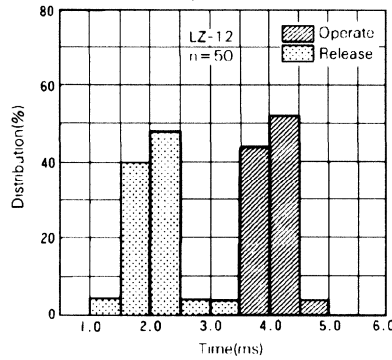


REFERENCE DATA

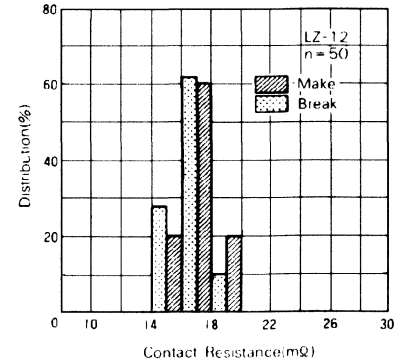
Distribution of Operate & Release Voltage



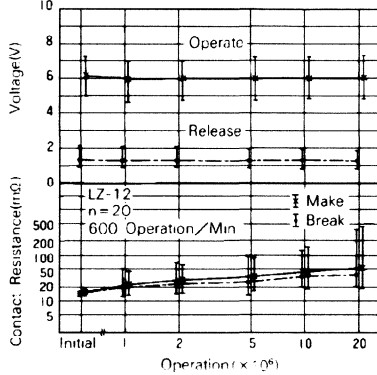
Distribution of Operation & Release Time



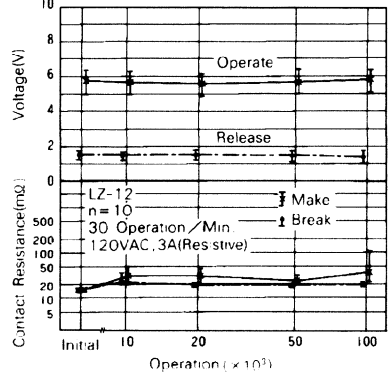
Distribution of Contact Resistance



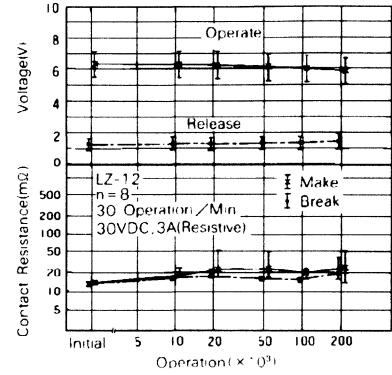
Mechanical Life Test



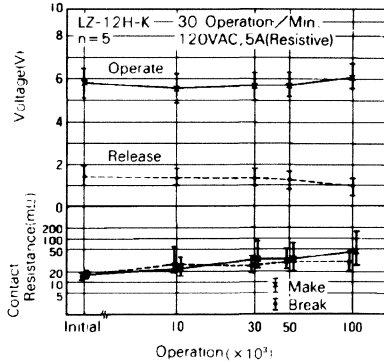
Electrical Life Test



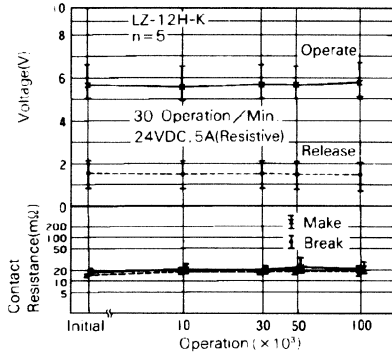
Electrical Life Test



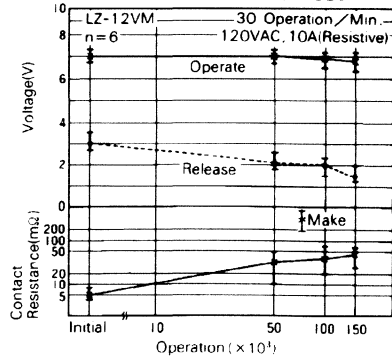
Electrical Life Test



Electrical Life Test



Electrical Life Test

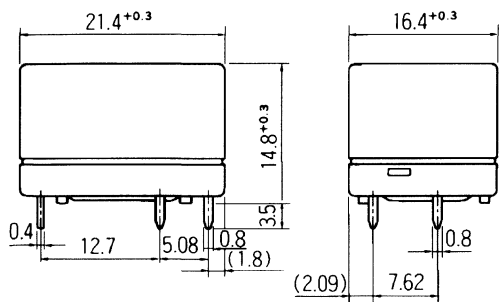


LZ SERIES

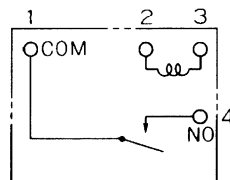
■ DIMENSIONS

● Dimensions

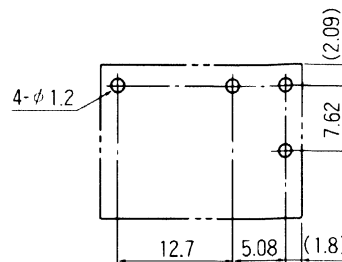
LZ-M type



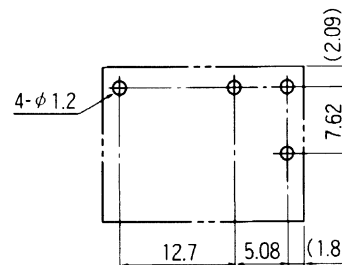
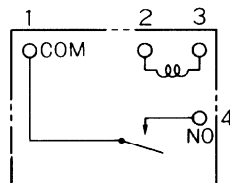
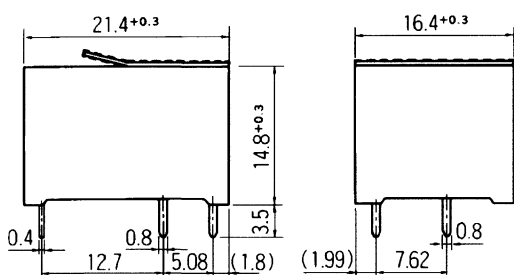
● Schematics (BOTTOM VIEW)



● PC board mounting hole layout (BOTTOM VIEW)

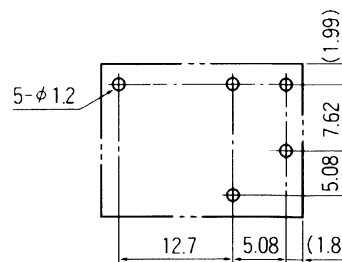
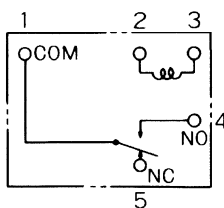
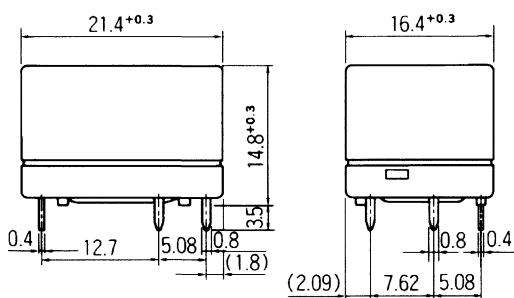


LZ-M-K, LZ-M-C type (Plastic sealed type)

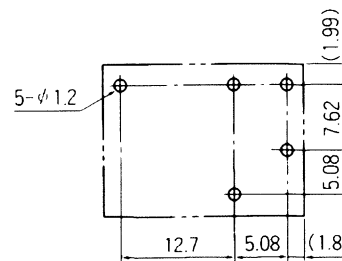
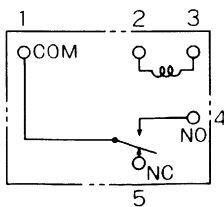
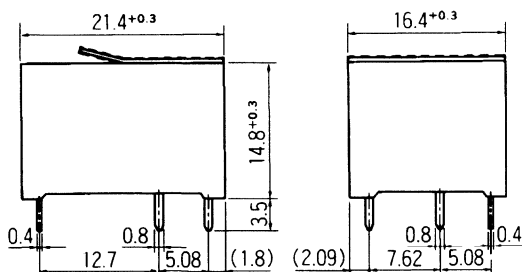


Dotted line: Seal tape [LZ-M-C Type]

LZ type



LZ-K, LZ-C type (Plastic sealed type)



Dotted line: Seal tape [LZ-C Type]

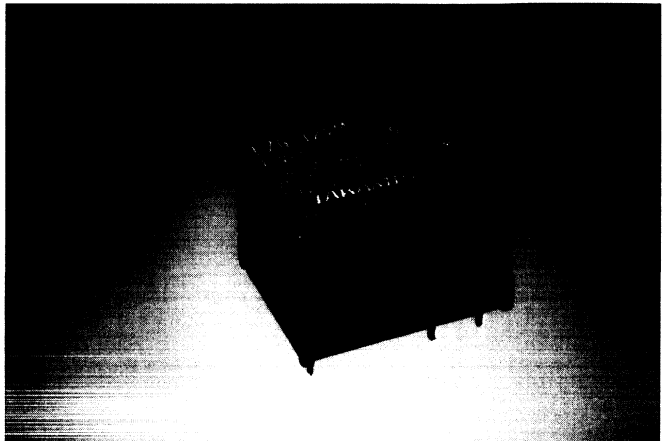
Unit: mm

POWER RELAY

1 POLE—1, 3, 5, 10 A (CADMIUM FREE CONTACTS TYPE) LZG SERIES

■ FEATURES

- UL (UL372, UL508, UL873), CSA, VDE
- 4 kinds of contact ratings
 - Low level to 10 amps switching
- Standard and high sensitivity types available
- High isolation in small package
 - Dielectric strength: 2,500 VAC (between coil and contacts)
 - Surge strength: 7,000 V
- UL class B (130°C) insulation type available (only plastic sealed type)
- Plastic sealed backfilled with nitrogen
- Printed circuit terminals compatible with LZ relay
- Environmentally friendly cadmium free contact type is available.



■ ORDERING INFORMATION

[Example] LZG – B 12 H M S E – K
 (a) (b) (c) (d) (e) (f) (g) (h)

| | | |
|-----|---------------------------|--|
| (a) | Series Name | LZG: LZG Series |
| (b) | Coil Heat Proof Class | Nil : Standard type B : UL Class B insulation type (130°C) |
| (c) | Nominal Voltage | Refer to the COIL DATA CHART |
| (d) | Contact Rating | Nil : 3 A H : 5 A V : 10 A (only LZG-M) W : 1 A (bifurcated) |
| (e) | Contact Arrangement | Nil : 1 form C (SPDT) M : 1 form A (SPST-NO) |
| (f) | Coil Type | Nil : Standard type S : High sensitivity type (without LZG-V) |
| (g) | Contact Material (Rating) | Nil : Gold overlay silver-palladium (only LZG-W) Nil : Gold overlay silver-nickel (3 A, 5 A) Nil : Silver alloy (10 A) (only LZG-VM) E : Silver-nickel (3 A, 5 A) |
| (h) | Enclosure | Nil : Flux free type K : Plastic sealed type (only LZG-B) C : Plastic sealed type (with tape) (only LZG-B) |

LZG SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL372, 508, 873 (File No. E56140)

C22.2 No. 0, No. 14 (File No. LR35579)

Please note that UL/CSA/VDE ratings may differ from the standard ratings. Only "NIL" and "H" contacts have VDE approval.

Please request when the approval markings are required on the cover and/or relay recognized by SEV is required.

| Type | Nominal voltage | Contact rating |
|-------------------------|--------------------------------|---|
| LZG- () LZG- ()S | 1.5 to 48 VDC 1.5 to 24 VDC | 1/10 HP 120 VAC/240 VAC 2.5 A 240 VAC resistive 3 A 30 VDC/120 VAC resistive Pilot duty D 150 |
| LZG- ()H LZG- ()HS | 1.5 to 48 VDC 1.5 to 24 VDC | 1/8 HP 120 VAC/240 VAC 4 A 240 VAC resistive 5 A 30 VDC/120 VAC resistive 1 A 250VAC inductive Pilot duty C 150 |
| LZG- ()VM | 1.5 to 48 VDC | 1/4 HP 120 VAC/240 VAC 7 A 240 VAC resistive 10 A 24 VDC/120 VAC resistive Pilot duty C 150 |

LZG SERIES

■ SPECIFICATIONS

| Item | | 10 A Type | 5 A Type | 3 A Type | 1 A Type |
|------------|-------------------------------------|--|--|---------------------------------------|-------------------------------|
| | | LZG-()VM | LZG-()H, LZG-()HE | LZG(), LZG-()E | LZG-()W |
| Contact | Arrangement | 1 form A (SPST-NO) | 1 form A (SPST-NO) or 1 form C (SPDT) | | |
| | Material | Silver alloy | Gold overlay silver alloy | | Gold overlay silver-palladium |
| | Style | Single | | | Bifurcated |
| | Resistance (initial) (at 1 A 6 VDC) | Maximum 70 mΩ (LZG-H) Maximum 100 mΩ (LZG-VM, HE, E) | | | Maximum 50 mΩ |
| | Rating (resistive) | 10 A 120 VAC/24 VDC 1/4 HP 120 VAC | 5 A 120 VAC/24 VDC 1/8 HP 120 VAC | 3 A 120 VAC/30 VDC 1/10 HP 120 VAC | 1 A 120 VAC/30 VDC |
| | Maximum Carrying Current | 10 A | 5 A | | 1 A |
| | Maximum Switching Power | 1,680 VA, 240 W | 960 VA, 120 W | 600 VA, 90 W | 190 VA, 30 W |
| | Maximum Switching Voltage | 250 VAC, 150 VDC | | | |
| | Maximum Switching Current | 10 A | 5 A | 3 A | 1 A |
| | Minimum Switching Load*1 | 10 mA 5 VDC (LZG-H) 100 mA 5 VDC (LZG-VM, HE, E) | | | 0.1 mA 100 VDC |
| Coil | Nominal Power (at 20°C) | Standard type: 0.45 to 0.6 W High sensitivity type: 0.33 W | | | |
| | Operate Power (at 20°C) | Standard type: 0.17 to 0.22 W High sensitivity type: 0.14 W | | | |
| | Operating Temperature | Standard type: -30°C to +70°C (no frost) High sensitivity type: -30°C to +80°C (no frost) (refer to the CHARACTERISTIC DATA) | | | |
| Time Value | Operate (at nominal voltage) | Maximum 7 ms | | | |
| | Release (at nominal voltage) | Maximum 4 ms | | | |
| Insulation | Resistance (at 500 VDC) | Minimum 250 MΩ | | | |
| | Dielectric Strength | between open contacts | 750 VAC 1 minute | | |
| | | between coil and contacts | 2,500 VAC 1 minute | | |
| | Surge Strength | 7,000 V (at 1.2 x 50 μs) | | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | | |
| | Electrical | 100 x 10 ³ operations minimum (rated load) | | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 3.3 mm) | | |
| | | Endurance | 10 to 55 Hz (double amplitude of 3.3 mm) | | |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ±1 ms) | | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | | |
| | Weight | Approximately 9.2 g | | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

LZG SERIES

■ COIL DATA CHART

| | MODEL | | | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage | Nominal power |
|-----------------------|----------------|-----------------------|----------------------|---------------------|-----------------|------------------------|----------------------|----------------------|---------------|
| | Single | | | Bifurcated | | | | | |
| | 10 A Type | 5 A Type | 3 A Type | 1 A Type | | | | | |
| Standard Type | LZG-(B) 1.5 VM | LZG-(B) 1.5H (M) (E) | LZG-(B) 1.5 (M) (E) | LZG-(B) 1.5 W (M) | 1.5 VDC | 5 Ω | 0.97 VDC | 0.08 VDC | 450 mW |
| | LZG-(B) 3 VM | LZG-(B) 3H (M) (E) | LZG-(B) 3 (M) (E) | LZG-(B) 3 W (M) | 3 VDC | 20 Ω | 1.95 VDC | 0.15 VDC | 450 mW |
| | LZG-(B) 5 VM | LZG-(B) 5H (M) (E) | LZG-(B) 5 (M) (E) | LZG-(B) 5 W (M) | 5 VDC | 56 Ω | 3.25 VDC | 0.25 VDC | 450 mW |
| | LZG-(B) 6 VM | LZG-(B) 6H (M) (E) | LZG-(B) 6 (M) (E) | LZG-(B) 6 W (M) | 6 VDC | 80 Ω | 3.9 VDC | 0.3 VDC | 450 mW |
| | LZG-(B) 9 VM | LZG-(B) 9H (M) (E) | LZG-(B) 9 (M) (E) | LZG-(B) 9 W (M) | 9 VDC | 180 Ω | 5.85 VDC | 0.45 VDC | 450 mW |
| | LZG-(B) 12 VM | LZG-(B) 12H (M) (E) | LZG-(B) 12 (M) (E) | LZG-(B) 12 W (M) | 12 VDC | 320 Ω | 7.8 VDC | 0.6 VDC | 450 mW |
| | LZG-(B) 18 VM | LZG-(B) 18H (M) (E) | LZG-(B) 18 (M) (E) | LZG-(B) 18 W (M) | 18 VDC | 720 Ω | 11.7 VDC | 0.9 VDC | 450 mW |
| | LZG-(B) 24 VM | LZG-(B) 24H (M) (E) | LZG-(B) 24 (M) (E) | LZG-(B) 24 W (M) | 24 VDC | 1,280 Ω | 15.6 VDC | 1.2 VDC | 450 mW |
| | LZG-(B) 48 VM | LZG-(B) 48H (M) (E) | LZG-(B) 48 (M) (E) | LZG-(B) 48 W (M) | 48 VDC | 3,800 Ω | 28.8 VDC | 2.4 VDC | 600 mW |
| High Sensitivity Type | | LZG-(B) 1.5H (M)S (E) | LZG-(B) 1.5 (M)S (E) | LZG-(B) 1.5 W (M) S | 1.5 VDC | 6.8 Ω | 0.97 VDC | 0.08 VDC | 330 mW |
| | | LZG-(B) 3H (M)S (E) | LZG-(B) 3 (M)S (E) | LZG-(B) 3 W (M) S | 3 VDC | 27 Ω | 1.95 VDC | 0.15 VDC | 330 mW |
| | | LZG-(B) 5H (M)S (E) | LZG-(B) 5 (M)S (E) | LZG-(B) 5 W (M) S | 5 VDC | 80 Ω | 3.25 VDC | 0.25 VDC | 330 mW |
| | | LZG-(B) 6H (M)S (E) | LZG-(B) 6 (M)S (E) | LZG-(B) 6 W (M) S | 6 VDC | 110 Ω | 3.9 VDC | 0.3 VDC | 330 mW |
| | | LZG-(B) 9H (M)S (E) | LZG-(B) 9 (M)S (E) | LZG-(B) 9 W (M) S | 9 VDC | 250 Ω | 5.85 VDC | 0.45 VDC | 330 mW |
| | | LZG-(B) 12H (M)S (E) | LZG-(B) 12 (M)S (E) | LZG-(B) 12 W (M) S | 12 VDC | 440 Ω | 7.8 VDC | 0.6 VDC | 330 mW |
| | | LZG-(B) 18H (M)S (E) | LZG-(B) 18 (M)S (E) | LZG-(B) 18 W (M) S | 18 VDC | 990 Ω | 11.7 VDC | 0.9 VDC | 330 mW |
| | | LZG-(B) 24H (M)S (E) | LZG-(B) 24 (M)S (E) | LZG-(B) 24 W (M) S | 24 VDC | 1,780 Ω | 15.6 VDC | 1.2 VDC | 330 mW |

Note: All values in the table are measured at 20 °C.

LZG SERIES

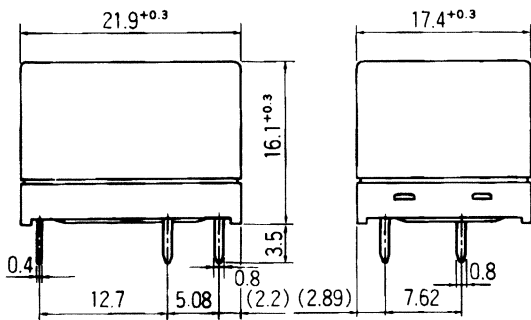
CHARACTERISTIC AND REFERENCE DATA

Please see LZ relays.

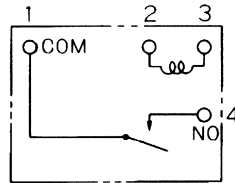
DIMENSIONS

Dimensions

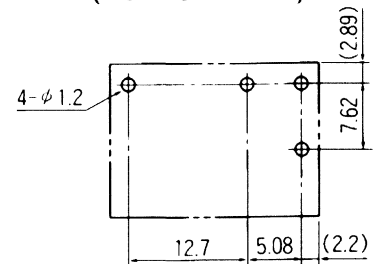
LZG-M type



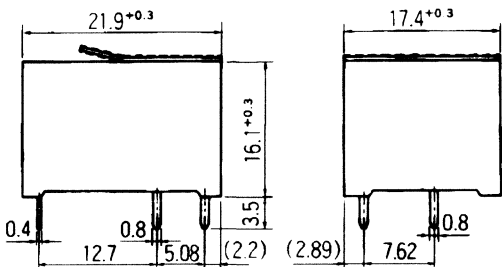
Schematics (BOTTOM VIEW)



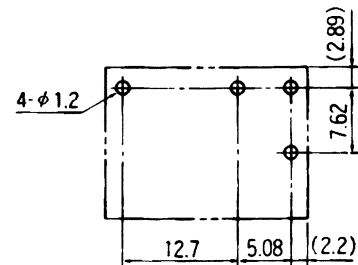
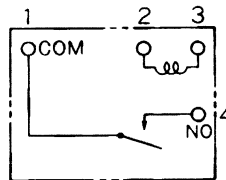
PC board mounting hole layout (BOTTOM VIEW)



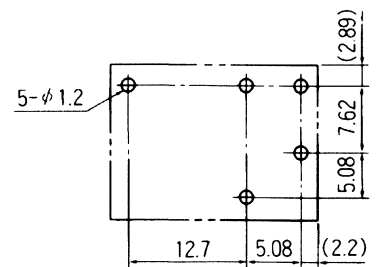
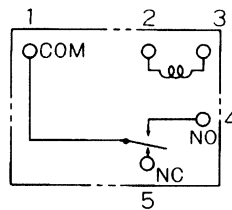
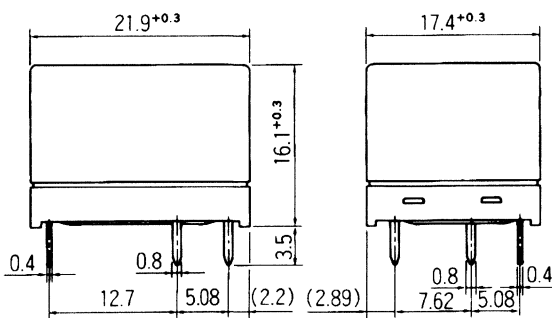
LZG-M-K, LZG-M-C type (Plastic sealed type)



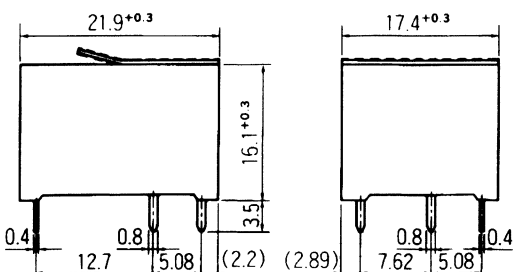
Dotted line : Seal tape (LZG-M-C type)



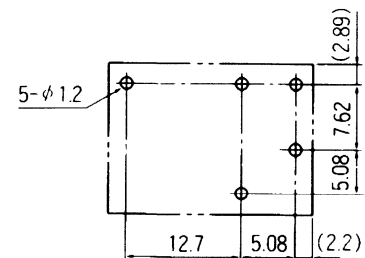
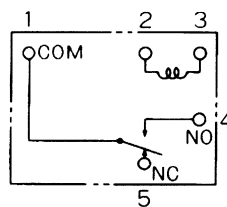
LZG type



LZG-K, LZG-C type (Plastic sealed type)



Dotted line : Seal tape (LZG-C type)



Unit: mm

LZG SERIES

NOTES



POWER RELAY

1 POLE 3, 5, 6 A

FBR100 SERIES

Please see FBR-160 Series for New Designs

■ FEATURES

- 10 A maximum contact carrying current
The B type can switch up to 10 A because of its beryllium-copper contact spring
- Conforms to various standards
UL recognized (File No. E63615)
CSA certified (File No. LR64026)
Japan Electric Appliance Control Law (JEACL)
Japan Electronic Components Reliability Center (RCJ)
Certified No. 50-095
- For automatic assembly
Tube packages that are suitable for automatic insertion equipment are available



■ ORDERING INFORMATION

[Example] FBR111 S E D 012 D W — B -CSA -S
(a) (b) (c) (d) (e) (f) (g) (h) (i) (j) (k)

| | | |
|-----|--|---|
| (a) | Series Name | FBR111: FBR100 Series (1 form C) FBR101: FBR100 Series (1 form A) |
| (b) | Enclosure | Nil : Standard S : Flux free N : Plastic sealed |
| (c) | Coil Rating | C : Standard E : High dielectric strength type U : UL recognized V : JEACL conformance, UL recognized (specify '—' or 'Nil' for (F) position.) |
| (d) | Coil | D : DC coil |
| (e) | Nominal Voltage | (Example) 005: 5 VDC coil 012: 12 VDC coil (refer to the COIL DATA CHART) |
| (f) | JEACL specification | D : JEACL conformance (specify '—' or 'Nil' when V is the (C) position.) — : Use hyphen when JEACL conformance is not needed. |
| (g) | Contact material UL Standard and Contact Material | Nil : Silver -H : Silver-cadmium oxide (6 A) -K : Silver-cadmium oxide (3 A) -W : Silver tin oxide alloy |

FBR100 SERIES

| | | |
|-----|--------------------|---|
| (h) | 0.36 W UL Standard | 1 : 0.36 W coil power dissipation UL recognized (only indicated when (c) position is U or V. — : Use hyphen when 0.36 W UL type is not needed. |
| (i) | 10 A type | B : 10 A maximum contact carrying current. |
| (j) | CSA Standard | Nil : Standard CSA : CSA recognized |
| (k) | Package Style | Nil : Standard tray S : Tube carrier |

Note: The designation name is stamped on the top of the relay case as follows:
 (Example) Designation ordered: FBR111SED024-W
 Stamp: 111SED024-W

■ SAFETY STANDARD AND FILE NUMBERS

UL 114 (File No. E63615)

C22.2 No. 0, No. 1, No. 14 (File No. LR40304 or LR64026)

| Nominal voltage | Type (contact material) | Contact rating | |
|-----------------|-----------------------------|----------------------|--|
| 5 to 48 VDC | Silver (nil) | 3 A | 120 VAC/28 VDC resistive |
| | Silver-cadmium oxide (-K) | 3 A | 120 VAC/28 VDC resistive |
| | Silver tin oxide alloy (-W) | 8.5 A 10 A 3 A | 28 VDC resistive 120 VAC resistive 120 VAC tungsten lamp |

FBR100 SERIES

■ SPECIFICATIONS

| Item | | — | -K | -H | -W |
|------------|--|--|--|---------------------------|------------------------|
| Contact | Arrangement and Style | 1 form C or 1 form A, single contact | | | |
| | Material | Silver | Silver-cadmium oxide | | Silver tin oxide alloy |
| | Resistance (initial) | Maximum 100 mΩ (silver contact at 6 VDC 0.5 A/other contacts at 6 VDC 1 A) | | | |
| | Ratings (resistive load) | 3 A 120 VAC 3 A 28 VDC | | 6 A 120 VAC 6 A 28 VDC | |
| | Maximum Carrying Current | 5 A | | 8 A or 10 A (-B type) | |
| | Maximum Switching Power | 360 VA/84 W | | 720 VA/168 W | |
| | Max. Switching Voltage* ¹ | 250 VAC/125 VDC | | | |
| | Minimum Switching Load* ² | 0.3 W (5 V, 30 mA) | | 0.3 W (5 V, 50 mA) | |
| Coil | Nominal Power | Approximately 360 to 450 mW/500 mW (at 20°C) | | | |
| | Operating Temperature | -30°C to +60°C (no frost) * ³ | | | |
| | Operate Humidity | 45 to 85% RH | | | |
| Time Value | Operate (at nominal voltage) | Maximum 20 msec | | | |
| | Release (at nominal voltage) | Maximum 10 msec | | | |
| Insulation | Resistance (initial) | Minimum 100 MΩ (at 500 VDC) | | | |
| | Dielectric Strength | Between open contacts | 500 VAC for 1 minute | | |
| | | Between coil and contacts | Standard type | : 500 VAC for 1 minute | |
| Life | Surge Strength | 3,500 V (at 1.2 x 50 μs) | | | |
| | Mechanical | 10 x 10 ⁶ operations minimum | | | |
| | Electrical (refer to the REFERENCE DATA) | DC | 100 x 10 ³ operations minimum (at rated contact load) | | |
| | | AC | 100 x 10 ³ operations minimum (at rated contact load) | | |
| Other | Vibration | 10 to 55 Hz (double amplitude of 1.5 mm) | | | |
| | Shock Resistance | No contact opening | 100 m/s ² (11 ± ¹ ms) | | |
| | | No damage | 1,000 m/s ² (11 ± ¹ ms) | | |
| | Weight | Approximately 15 g | | | |

*¹ If the switching voltage exceeds the rated contact voltage, reduce the current. The current values vary according to the type of load.

*² Values when switching a resistive load at normal room temperature and humidity, and in a clean environment. The minimum switching load varies with the switching frequency and operation environment.

*³ Based on UL Class A coil insulation system.

FBR100 SERIES

COIL RATINGS

1. 0.36 WATT COIL TYPE

| MODEL | | | | | | Nominal voltage | Coil resistance (±10%) | Nominal current (at nominal voltage) approx. | Must operate voltage | Must release voltage | Maximum allowable voltage | Nominal power | Coil temperature rise |
|---|--------------|----------------|---|--------------|----------------|-----------------|------------------------|--|-----------------------------|-----------------------------|---------------------------|-------------------------------------|-------------------------------------|
| 1 Form C type | | | 1 Form A type | | | | | | | | | | |
| Standard | Flux free | Plastic sealed | Standard | Flux free | Plastic sealed | | | | | | | | |
| FBR111()CD(),-K,-H,-H-B,-W,-W-B ,D,DK,DH,DH-B,DW,DW-B FBR111()ED(),-K,-H,-H-B,-W,-W-B ,D,DK,DH,DH-B,DW,DW-B ,G,GK,GH,GH-B,GW,GW-B FBR111()UD(),-1-CSA,-K1-CSA,-W1-CSA,-W1-B FBR111()VD(),-1-CSA,-K1-CSA,-W1-CSA,-W1-B | | | FBR101()CD(),-K,-H,-H-B,-W,-W-B ,D,DK,DH,DH-B,DW,DW-B FBR101()ED(),-K,-H,-H-B,-W,-W-B ,D,DK,DH,DH-B,DW,DW-B ,G,GK,GH,GH-B,GW,GW-B FBR101()UD(),-1-CSA,-K1-CSA,-W1-CSA,-W1-B FBR101()VD(),-1-CSA,-K1-CSA,-W1-CSA,-W1-B | | | 5 VDC | 70 Ω | 71 mA | 80% max. of nominal voltage | 10% min. of nominal voltage | 210% of nominal voltage | Approx. 360 mW (at nominal voltage) | Approx. 30 deg (at nominal voltage) |
| FBR111CD005 | FBR111SCD005 | FBR111NCD005 | FBR101CD005 | FBR101SCD005 | FBR101NCD005 | 6 VDC | 100 Ω | 60 mA | | | | | |
| FBR111CD006 | FBR111SCD006 | FBR111NCD006 | FBR101CD006 | FBR101SCD006 | FBR101NCD006 | 9 VDC | 225 Ω | 40 mA | | | | | |
| FBR111CD009 | FBR111SCD009 | FBR111NCD009 | FBR101CD009 | FBR101SCD009 | FBR101NCD009 | 12 VDC | 400 Ω | 30 mA | | | | | |
| FBR111CD012 | FBR111SCD012 | FBR111NCD012 | FBR101CD012 | FBR101SCD012 | FBR101NCD012 | 18 VDC | 900 Ω | 20 mA | | | | | |
| FBR111CD018 | FBR111SCD018 | FBR111NCD018 | FBR101CD018 | FBR101SCD018 | FBR101NCD018 | 24 VDC | 1,600 Ω | 15 mA | | | | | |
| FBR111CD024 | FBR111SCD024 | FBR111NCD024 | FBR101CD024 | FBR101SCD024 | FBR101NCD024 | 48 VDC | 5,100 Ω | 9 mA | | | | | |

Note: All values in the table are measured at 20°C.

2. 0.5 WATT COIL TYPE

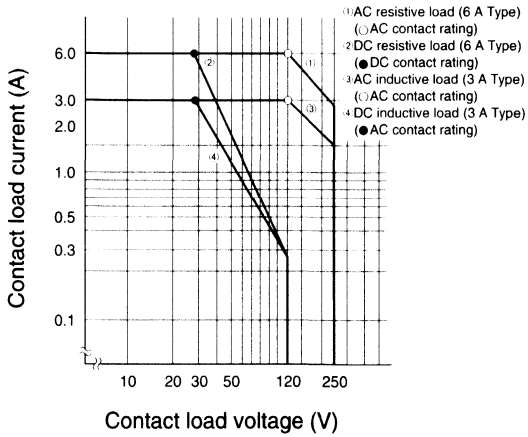
| MODEL | | | | | | Nominal voltage | Coil resistance (±10%) | Nominal current (at nominal voltage) approx. | Must operate voltage | Must release voltage | Maximum allowable voltage | Nominal power | Coil temperature rise |
|---|--------------|----------------|---|--------------|----------------|-----------------|------------------------|--|-----------------------------|-----------------------------|---------------------------|-------------------------------------|-------------------------------------|
| 1 Form C type | | | 1 Form A type | | | | | | | | | | |
| Standard | Flux free | Plastic sealed | Standard | Flux free | Plastic sealed | | | | | | | | |
| FBR111()CD(),-K,-H,-H-B,-W,-W-B ,D,DK,DH,DH-B,DW,DW-B FBR111()ED(),-K,-H,-H-B,-W,-W-B ,D,DK,DH,DH-B,DW,DW-B ,G,GK,GH,GH-B,GW,GW-B FBR111()UD(),-CSA,-K-CSA,-W-CSA,-W-B FBR111()VD(),-CSA,-K-CSA,-W-CSA,-W-B | | | FBR101()CD(),-K,-H,-H-B,-W,-W-B ,D,DK,DH,DH-B,DW,DW-B FBR101()ED(),-K,-H,-H-B,-W,-W-B ,D,DK,DH,DH-B,DW,DW-B ,G,GK,GH,GH-B,GW,GW-B FBR101()UD(),-CSA,-K-CSA,-W-CSA,-W-B FBR101()VD(),-CSA,-K-CSA,-W-CSA,-W-B | | | 5 VDC | 50 Ω | 100 mA | 75% max. of nominal voltage | 10% min. of nominal voltage | 170% of nominal voltage | Approx. 500 mW (at nominal voltage) | Approx. 35 deg (at nominal voltage) |
| FBR111CD005 | FBR111SCD005 | FBR111NCD005 | FBR101CD005 | FBR101SCD005 | FBR101NCD005 | 6 VDC | 72 Ω | 83 mA | | | | | |
| FBR111CD006 | FBR111SCD006 | FBR111NCD006 | FBR101CD006 | FBR101SCD006 | FBR101NCD006 | 9 VDC | 160 Ω | 56 mA | | | | | |
| FBR111CD009 | FBR111SCD009 | FBR111NCD009 | FBR101CD009 | FBR101SCD009 | FBR101NCD009 | 12 VDC | 290 Ω | 41 mA | | | | | |
| FBR111CD012 | FBR111SCD012 | FBR111NCD012 | FBR101CD012 | FBR101SCD012 | FBR101NCD012 | 18 VDC | 650 Ω | 28 mA | | | | | |
| FBR111CD018 | FBR111SCD018 | FBR111NCD018 | FBR101CD018 | FBR101SCD018 | FBR101NCD018 | 24 VDC | 1,150 Ω | 21 mA | | | | | |
| FBR111CD024 | FBR111SCD024 | FBR111NCD024 | FBR101CD024 | FBR101SCD024 | FBR101NCD024 | 48 VDC | 4,600 Ω | 10 mA | | | | | |

Note: All values in the table are measured at 20°C.

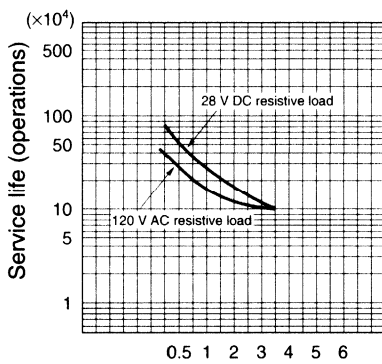
FBR100 SERIES

CHARACTERISTIC DATA

Maximum switching capacity

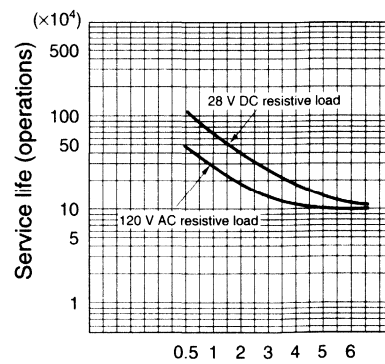


Life curve (3 A type)



Contact load current (A)

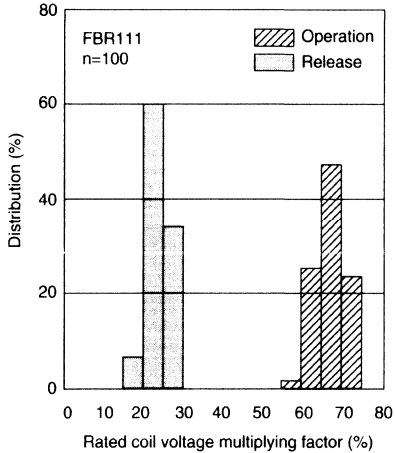
Life curve (6 A type)



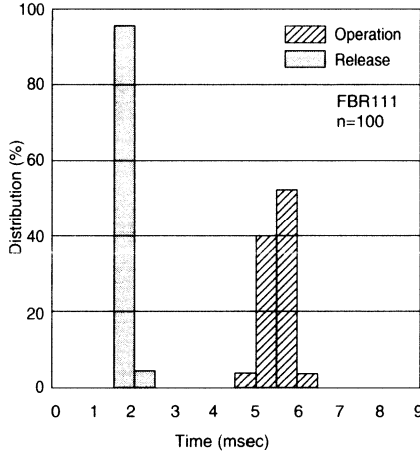
Contact load current (A)

REFERENCE DATA

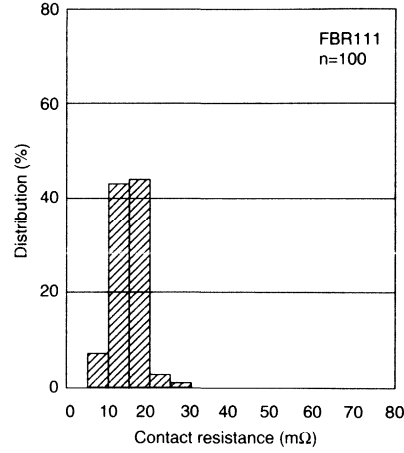
Distribution of operate and release voltage



Distribution of operate and release time



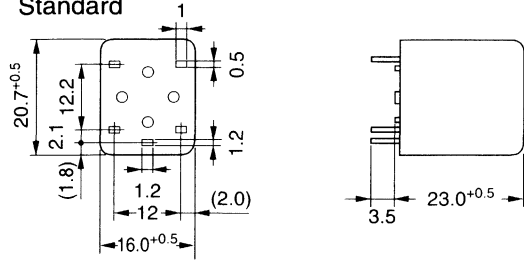
Distribution of contact resistance



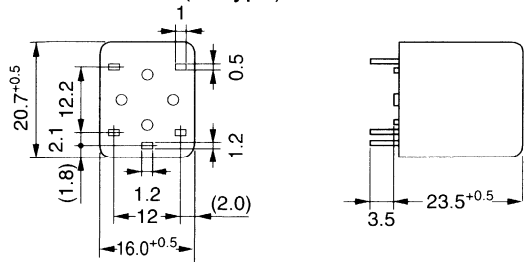
FBR100 SERIES

■ DIMENSIONS

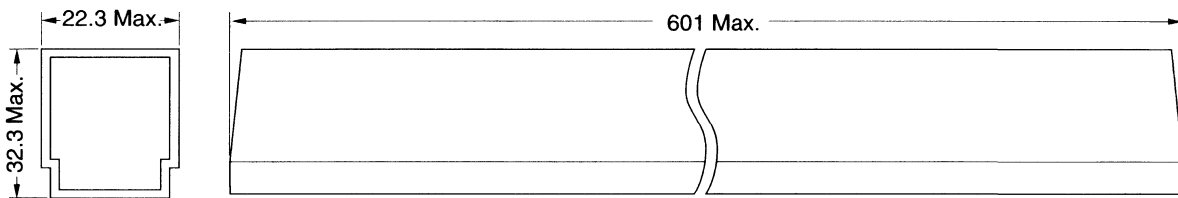
- Dimensions Standard



- Plastic sealed (N Type)



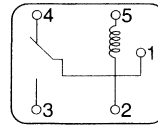
- Tube carrier



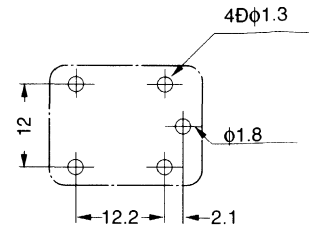
25 pcs/Tube

Unit: mm

- Schematics (BOTTOM VIEW)



- PC board mounting hole layout (BOTTOM VIEW)



Note: For 1 form A type, terminal No. 4 is removed.

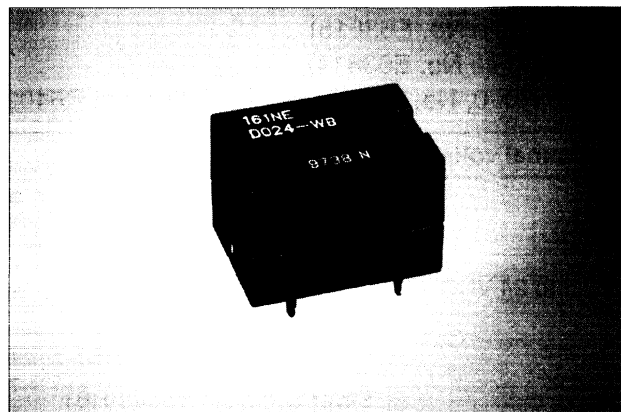
POWER RELAY

1 POLE—3, 5, 10 A

FBR160 SERIES

■ FEATURES

- Compact with high power (3 A to 10 A)
- 6 types of contact materials available for home electronics and automotive applications
- Design conforms to the following safety standards
 - UL114 No. E63615
 - UL508 No. E63614
 - CSA No. LR64026
 - Japan Electric Appliance Control Law (150–300 V)
- For automatic assembly
Tube packaging suitable for automatic insertion equipment is available



■ ORDERING INFORMATION

[Example] FBR16 1 S E D 012 UH -CSA -*** -S
 (a) (b) (c) (d) (e) (f) (g) (h) (i) (j)

| | | | | |
|-----|----------------------------------|---|-----------------------------------|---|
| (a) | Series Name | FBR16: FBR160 Series | | |
| (b) | Contact Arrangement | 1 : 1 form C (SPDT) 3 : 1 form A (SPST-NO) | | |
| (c) | Enclosure | S : Flux free N : Plastic sealed | | |
| (d) | Coil Rating | E : Nominal power 0.36 W type C : Nominal power 0.5 W type (refer to the SPECIFICATIONS) | | |
| (e) | Coil | D : DC Coil | | |
| (f) | Nominal Voltage | (Example) 012: 12 VDC coil 024: 24 VDC coil (refer to the COIL DATA CHART) | | |
| (g) | UL Standard and Contact Material | UL 114 recognized | UL508 recognized | Material / Rating |
| | | U UK UH UW UHB UWB | R RK RH RW RHB RWB | Silver (3A) Silver-cadmium oxide (3 A) Silver-cadmium oxide (5 A) Silver tin oxide alloy (5 A) Silver-cadmium oxide (AC 10 A) Silver tin oxide alloy (DC 10 A) |

(Continued)

FBR160 SERIES

| | | |
|-----|--------------------|---|
| (h) | CSA Standard | No designation: standard -CSA: CSA recognized (g) specifies UL 114 or UL 508 |
| (i) | Custom Designation | Suffix number for custom design |
| (j) | Package Style | Nil : Standard tray -S : Tube carrier |

Note: The designation name is stamped on the top of the relay case as follows:
 (Example) Designation ordered: FBR161NED012-H
 Stamp: 161NED012-H

■ SAFETY STANDARD AND FILE NUMBERS

UL 114 (File No. E63615)

UL 508 (File No. E63614)

C22.2 No. 0, No. 14 (File No. LR40304 or LR64026)

| Nominal voltage | Type (contact material) | Contact rating | |
|-----------------|------------------------------|------------------------|-------------------------------------|
| 5 to 24 VDC | Silver (no designation) | 3 A | 120 VAC/ 30 VDC resistive |
| | Silver-cadmium oxide (-K) | 1/10 HP | 120 VAC |
| | Silver-cadmium oxide(-H) | 5 A | 120 VAC/30 VDC resistive |
| | Silver tin oxide alloy (-W) | 1/6 HP | 120 VAC |
| | Silver tin oxide alloy (-WB) | 10 A (N.O.) 7 A (N.C.) | 120 VAC/250 VAC resistive |
| | Silver-cadmium oxide (-HB) | 10 A 1/8 HP | 30 VDC resistive 120 VAC/250 VAC |

FBR160 SERIES

■ SPECIFICATIONS

| Item | | — | -K | -H | -W | -HB | -WB |
|------------|--|--|--|---------------------------|----------------------|---|--------------------|
| Contact | Arrangement and Style | 1 form C or 1 form A, single contact | | | | | |
| | Material | Silver | Silver-cadmium oxide | Silver tin oxide alloy | Silver-cadmium oxide | Silver tin oxide alloy | |
| | Resistance (initial) | Maximum 100 mΩ (silver contact at 0.5 A 6 VDC/other contacts at 1 A 6 VDC) | | | | | |
| | Ratings (resistive load) | 3 A 120 VAC 3 A 28 VDC | | 5 A 120 VAC 5 A 28 VAC | 5 A 28 VDC | 10 A 120 VAC (N.O.) 7 A 120 VAC (N.C.) | 10 A 28 VDC |
| | Maximum Carrying Current | 5 A | | | | 10 A | |
| | Maximum Switching Power | 360 VA or 84 W | | 600 VA or 140 W | 140 W | 1,200 VA | 280 W |
| | Max. Switching Voltage* ¹ | 250 VAC or 125 VDC | | | | | |
| | Minimum Switching Load* ² | 0.3 W (30 mA 5 V) | | 0.3 W (50 mA 5 V) | 0.5 W (100 mA 5 V) | 0.5 W (100 mA 5 V) | 0.5 W (100 mA 5 V) |
| Coil | Nominal Power | Approx. 0.36 W (E coil type)/0.5 W (C coil type) (at 20°C) | | | | | |
| | Operating Temperature | -30°C to +80°C (no frost) * ³ | | | | | |
| | Operate Humidity | 45 to 85% RH | | | | | |
| Time Value | Operate (at nominal voltage) | Maximum 10 msec | | | | | |
| | Release (at nominal voltage) | Maximum 5 msec | | | | | |
| Insulation | Resistance (initial) | Minimum 100 MΩ (at 500 VDC) | | | | | |
| | Dielectric Strength | Between coil and contacts | 1,500 VAC 1 minute | | | | |
| | | Between open contacts | 500 VAC 1 minute | | | | |
| | Surge Strength | 3,500 V (at 1.2 x 50 μs) | | | | | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | | | | | |
| | Electrical (refer to the REFERENCE DATA) | DC | 100 x 10 ³ operations minimum (at contact rating) | | | | |
| | | AC | 100 x 10 ³ operations minimum (at contact rating) | | | | |
| Other | Vibration Resistance | 10 to 300 Hz (double amplitude of 3.3 mm) | | | | | |
| | Shock Resistance | No contact opening | 100 m/s ² (11 ± ¹ ms) | | | | |
| | | No damage | 1,000 m/s ² (11 ± ¹ ms) | | | | |
| | Weight | Approximately 11 g | | | | | |

*¹ If the switching voltage exceeds the rated contact voltage, reduce the current. The current values vary according to the type of load.

*² Values when switching a resistive load at normal room temperature and humidity, and in a clean environment. The minimum switching load varies with the switching frequency and operation environment.

*³ Based on UL Class A coil insulation system.

FBR160 SERIES

■ COIL RATINGS

1. E (0.36 WATT COIL TYPE) (TYPE E)

| MODEL | | | | Nominal voltage | Coil resistance (±10%) | Nominal current (at nominal voltage) approx. | Must operate voltage | Must release voltage | Maximum allowable voltage | Nominal power | Coil temperature rise |
|---------------|----------------|---------------|----------------|-----------------|------------------------|--|-----------------------------|-----------------------------|---------------------------|-------------------------------------|-------------------------------------|
| 1 Form C type | | 1 Form A type | | | | | | | | | |
| Flux free | Plastic sealed | Flux free | Plastic sealed | | | | | | | | |
| FBR161SED005 | FBR161NED005 | FBR163SED005 | FBR163SED005 | 5 VDC | 70 Ω | 71 mA | 80% max. of nominal voltage | 10% min. of nominal voltage | 210% of nominal voltage | Approx. 360 mW (at nominal voltage) | Approx. 30 deg (at nominal voltage) |
| FBR161SED006 | FBR161NED006 | FBR163SED006 | FBR163SED006 | 6 VDC | 100 Ω | 60 mA | | | | | |
| FBR161SED009 | FBR161NED009 | FBR163SED009 | FBR163SED009 | 9 VDC | 225 Ω | 40 mA | | | | | |
| FBR161SED012 | FBR161NED012 | FBR163SED012 | FBR163SED012 | 12 VDC | 400 Ω | 30 mA | | | | | |
| FBR161SED024 | FBR161NED024 | FBR163SED024 | FBR163SED024 | 24 VDC | 1,600 Ω | 15 mA | | | | | |

Note: All values in the table are measured at 20°C.

2. C (0.5 WATT COIL TYPE) (TYPE C)

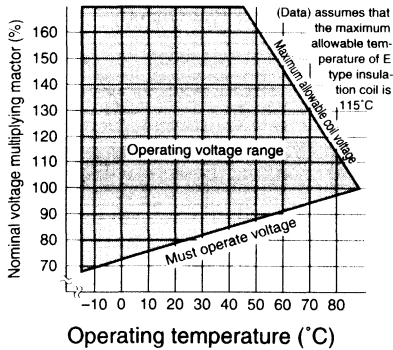
| MODEL | | | | Nominal voltage | Coil resistance (±10%) | Nominal current (at nominal voltage) approx. | Must operate voltage | Must release voltage | Maximum allowable voltage | Nominal power | Coil temperature rise |
|---------------|----------------|---------------|----------------|-----------------|------------------------|--|-----------------------------|-----------------------------|---------------------------|-------------------------------------|-------------------------------------|
| 1 Form C type | | 1 Form A type | | | | | | | | | |
| Flux free | Plastic sealed | Flux free | Plastic sealed | | | | | | | | |
| FBR161SCD005 | FBR161NCD005 | FBR163SCD005 | FBR163SCD005 | 5 VDC | 50 Ω | 100 mA | 75% max. of nominal voltage | 10% min. of nominal voltage | 210% of nominal voltage | Approx. 500 mW (at nominal voltage) | Approx. 35 deg (at nominal voltage) |
| FBR161SCD006 | FBR161NCD006 | FBR163SCD006 | FBR163SCD006 | 6 VDC | 72 Ω | 83 mA | | | | | |
| FBR161SCD009 | FBR161NCD009 | FBR163SCD009 | FBR163SCD009 | 9 VDC | 162 Ω | 56 mA | | | | | |
| FBR161SCD012 | FBR161NCD012 | FBR163SCD012 | FBR163SCD012 | 12 VDC | 288 Ω | 42 mA | | | | | |
| FBR161SCD024 | FBR161NCD024 | FBR163SCD024 | FBR163SCD024 | 24 VDC | 1,152 Ω | 21 mA | | | | | |

Note: All values in the table are measured at 20°C.

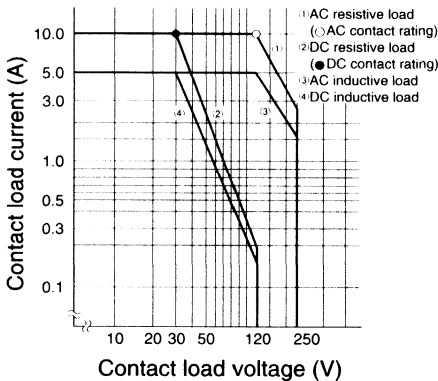
FBR160 SERIES

CHARACTERISTIC DATA

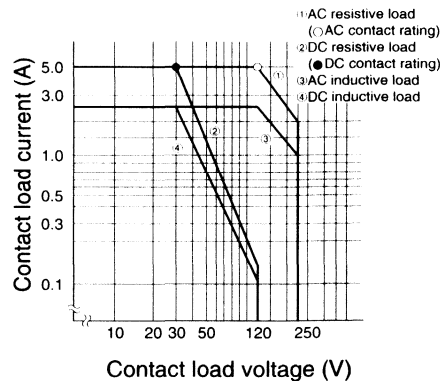
Range of operation temperature and voltage
E type [0.36 W type]



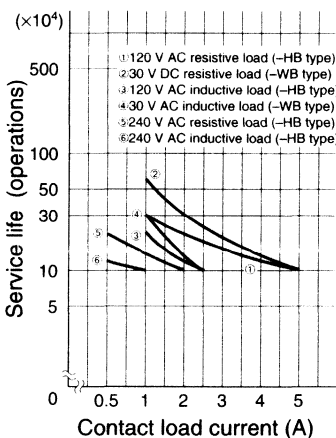
Maximum switching capacity (10 A type)



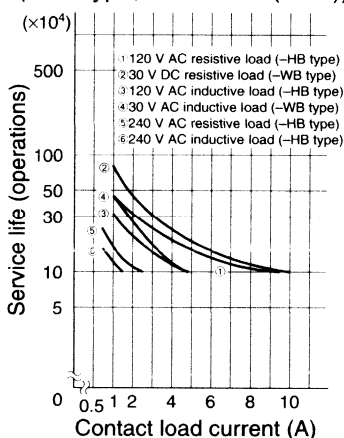
Maximum switching capacity (5 A type)



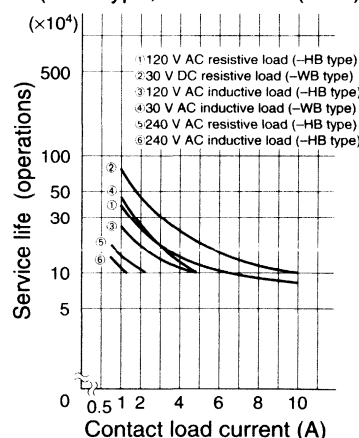
Life curve (5 A type)



Life curve (10 A type, make side (N.O.))

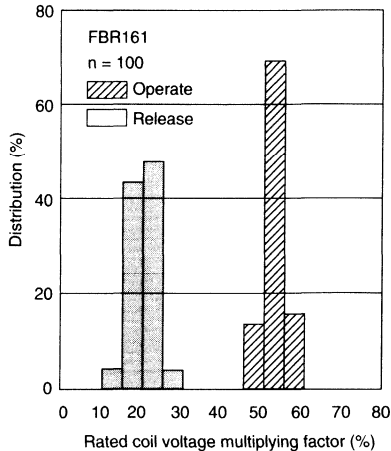


Life curve (10 A type, breake side (N.C.))

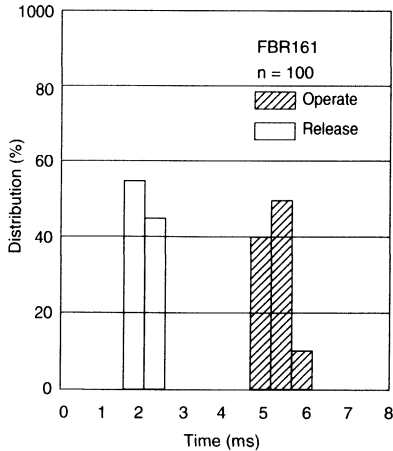


REFERENCE DATA

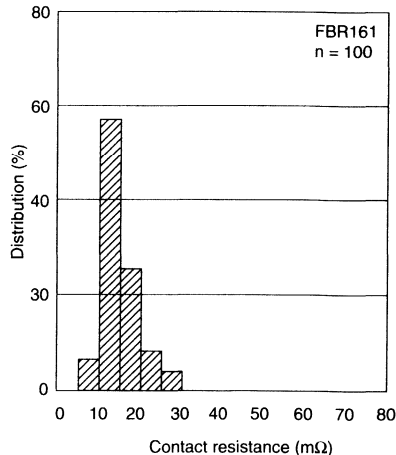
Distribution of operate and release voltage



Distribution of operate and release time



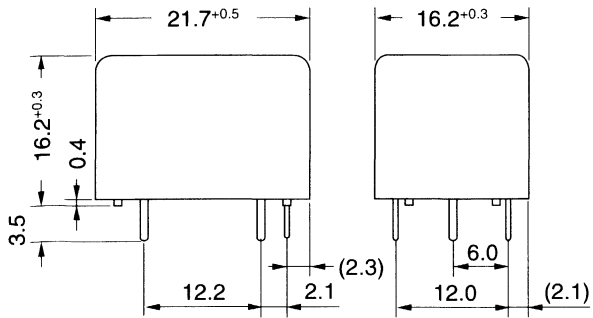
Distribution of contact resistance



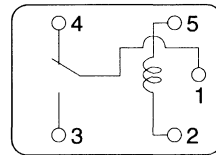
FBR160 SERIES

■ DIMENSIONS

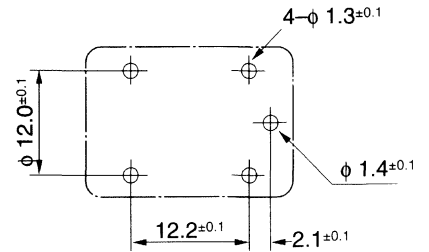
● Dimensions



● Schematic (BOTTOM VIEW)

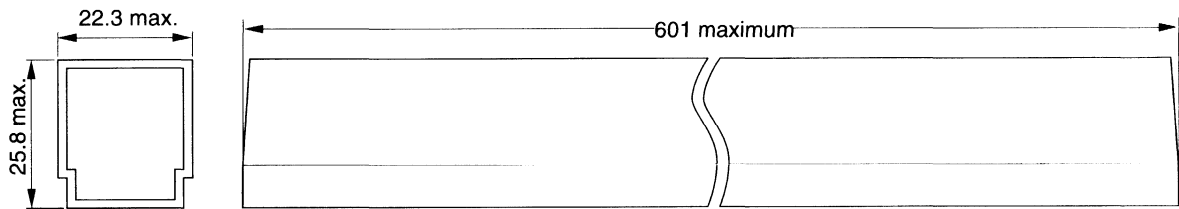


● PC board mounting hole layout (BOTTOM VIEW)



Note : For 1 form A type, terminal No.4 is removed.

● Tube carrier



25 pieces/tube

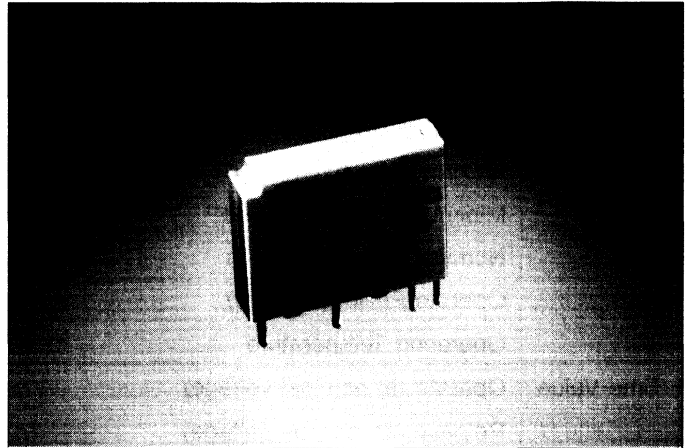
Unit: mm

POWER RELAY

1 POLE—5 A (CADMIUM FREE CONTACTS TYPE) NY SERIES

■ FEATURES

- Ultra slim type with 5 mm thickness
—Good for high density mounting
- Low power consumption and high sensitivity
—Nominal coil power: 120 mW
—Operating power: 54 mW
- UL, CSA, VDE recognized
- Conforms to IEC 1010-1 and 1131-2
- Wide operating range
- SIL pitch terminals
- Plastic sealed type backfilled with nitrogen
- Compatible with solid state I/O module type SN (see page 357) in size and pin (terminal) arrangement
- Environmentally friendly cadmium free contact type is available.



■ ORDERING INFORMATION

[Example] $\frac{NY}{(a)} \frac{P}{(b)} - \frac{12}{(*)} \frac{W}{(c)} - \frac{K}{(e)} - \frac{IE}{(f)}$

| | | |
|-----|-------------------------|--|
| (a) | Series Name | NY: NY Series |
| (b) | Terminal Classification | Nil : PC board mounting type P : Socket mounting type |
| (c) | Nominal Voltage | Refer to the COIL DATA CHART |
| (d) | Contact | W : Bifurcated type |
| (e) | Enclosure | K : Plastic sealed type |
| (f) | Isolation | Nil : Standard IE : High isolation |

Note: Actual marking omits the hyphen (-) of (*)

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E56140)

C22.2 No. 14 (File No. LR35579)

VDE0435

Please note that UL/CSA ratings may differ from the standard ratings.

| Nominal voltage | Contact rating |
|-----------------|--|
| 4.5 to 24 VDC | 1/8 HP 125 VAC/250 VAC 5 A 30 VDC/250 VAC resistive Pilot duty C 300 |

NY SERIES

■ SPECIFICATIONS

| Item | | NY | IE | |
|----------------|--------------------------------------|---|--|------------------|
| Contact | Arrangement | 1 form A (SPST-NO) | | |
| | Material | Gold overlay silver alloy | | |
| | Style | Bifurcated | | |
| | Resistance (Initial) | Maximum 30 mΩ (at 1 A 6 VDC) | | |
| | Rating (resistive) | 5 A 250 VAC or 5 A 30 VDC | | |
| | Maximum Carrying Current | 5 A | | |
| | Maximum Switching Power | 750 VA, 90 W | | |
| | Maximum Switching Voltage | 270 VAC, 150 VDC | | |
| | Maximum Switching Current | 5 A | | |
| | Minimum Switching Load* ¹ | 0.1 mA 100 mVDC | | |
| Coil | Nominal Power (at 20°C) | 0.12W | | |
| | Operate Power (at 20°C) | 0.054 W | | |
| | Operating Temperature | -40°C to +90°C (no frost) (refer to the CHARACTERISTIC DATA) | | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | | |
| | Release (at nominal voltage) | Maximum 5 ms | | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | |
| | Dielectric Strength | between open contacts | 750 VAC 1 minute | |
| | | between coil and contacts | 2,000 VAC 1 min. | 3,600 VAC 1 min. |
| Surge Strength | 4,000 V (at 1.2 x 50 μs) | 5,080 V (at 1.2 x 50 μs) | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | |
| | Electrical | 100 x 10 ³ operations minimum (at 5A 30VDC) 150 x 10 ³ operations minimum (at 3 A 120 VAC) 30 x 10 ³ operations minimum (at 5 A 250 VAC) | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 5.0 mm) | |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ± 1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ± 1 ms) | |
| | Weight | Approximately 3.5 g | | |

*¹ Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

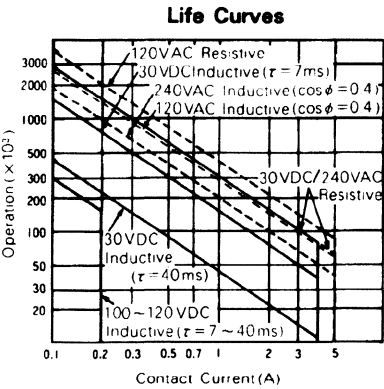
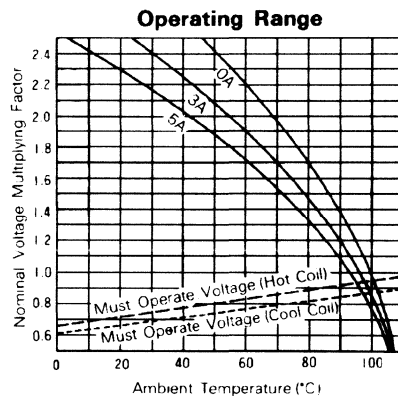
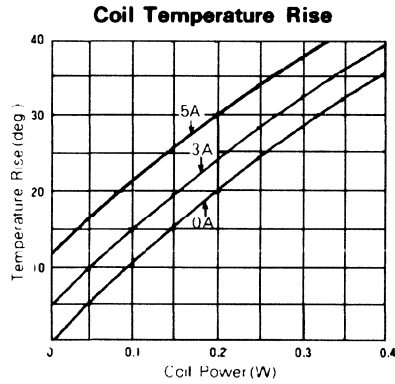
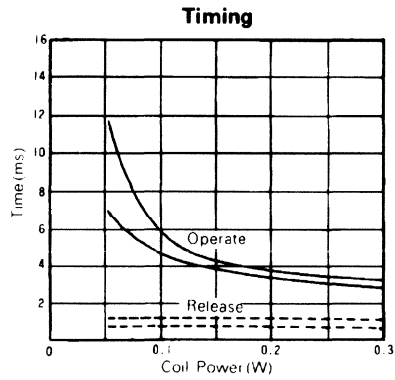
NY SERIES

COIL DATA CHART

| MODEL | Nominal voltage | Coil resistance ($\pm 10\%$) | Must operate voltage | Must release voltage | Nominal power |
|-------------|-----------------|--------------------------------|----------------------|----------------------|---------------|
| NY- 4.5 W-K | 4.5 VDC | 169 Ω | 3 VDC | 0.45 VDC | 120 mW |
| NY- 5 W-K | 5 VDC | 208 Ω | 3.35 VDC | 0.5 VDC | 120 mW |
| NY- 6 W-K | 6 VDC | 300 Ω | 4 VDC | 0.6 VDC | 120 mW |
| NY- 9 W-K | 9 VDC | 675 Ω | 6 VDC | 0.9 VDC | 120 mW |
| NY- 12 W-K | 12 VDC | 1,200 Ω | 8 VDC | 1.2 VDC | 120 mW |
| NY- 18 W-K | 18 VDC | 2,700 Ω | 12.1 VDC | 1.8 VDC | 120 mW |
| NY- 24 W-K | 24 VDC | 4,800 Ω | 16.1 VDC | 2.4 VDC | 120 mW |

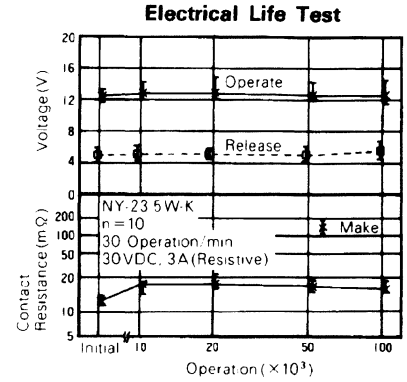
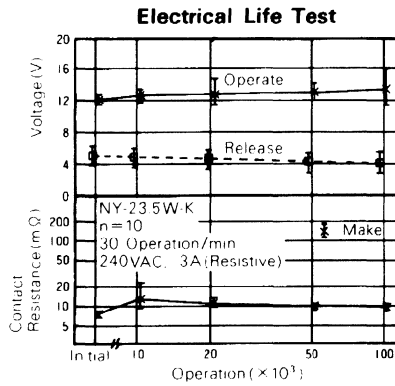
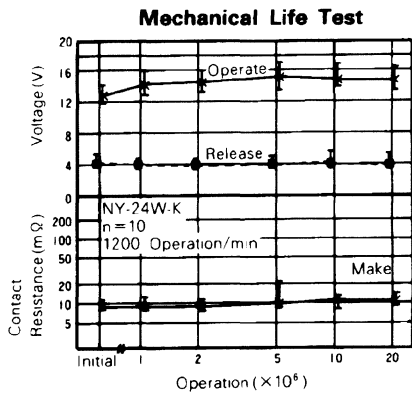
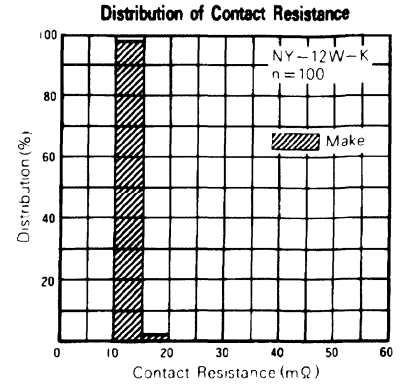
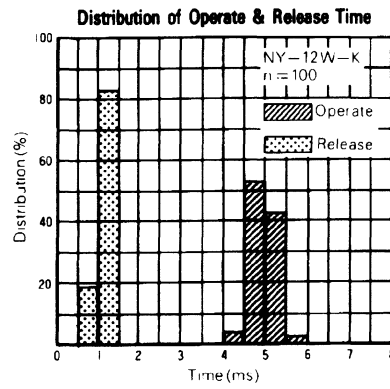
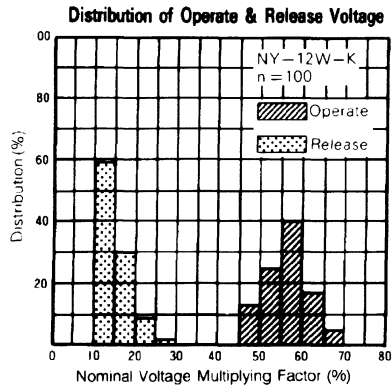
Note: All values in the table are measured at 20°C

CHARACTERISTIC DATA



NY SERIES

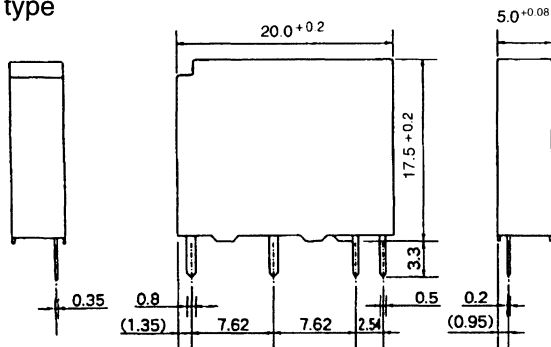
REFERENCE DATA



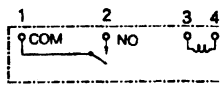
DIMENSIONS

Dimensions

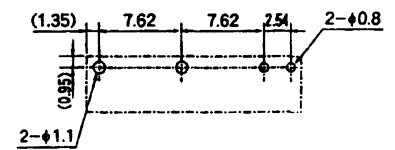
NY type



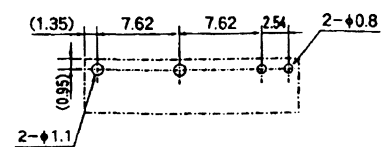
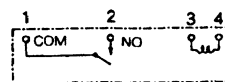
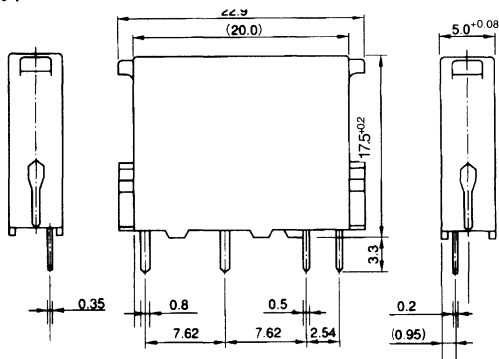
Schematics (BOTTOM VIEW)



PC board mounting hole layout (BOTTOM VIEW)



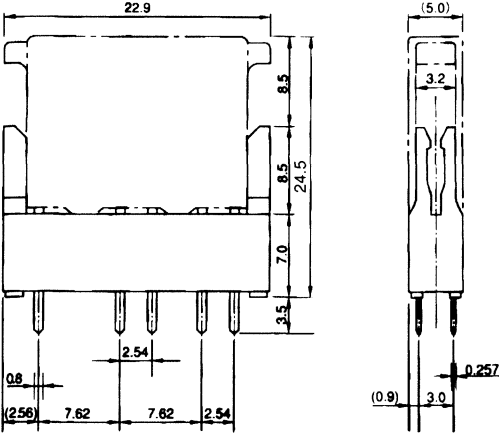
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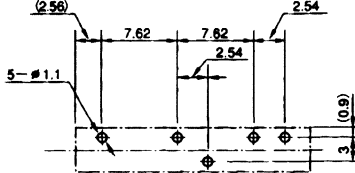
Unit: mm

NY SERIES

■ SOCKET DIMENSIONS



■ SOCKET DRILLING PLANT



Unit: mm

■ NOTES

- 1. Socket ordering code. JL-5N
- 2. Standard IC socket is not recommended. Please use socket JL-5N.

NY SERIES

NOTES



POWER RELAY

1 POLE—5 A (MEDIUM LOAD CONTROL) VE SERIES

■ FEATURES

- UL, CSA, VDE recognized
- 1 form A (SPST-NO) or 1 form C (SPDT) contact
- Low cost, big performance in small package
—Surge strength: 4,000 V or 6,000 V
- Slim type—meets high density mounting requirement
- Wide operating range
- Easy circuit design with completely separated terminal arrangement (coil and contact terminals)
- Plastic sealed type backfilled with nitrogen



■ ORDERING INFORMATION

[Example] $\frac{VE}{(a) (*)} - \frac{12}{(b)} \frac{H}{(c)} \frac{M}{(d)} \frac{S}{(e)} \frac{E}{(f)} - \frac{K}{(g)} - \frac{HV}{(h)} - \frac{VD}{(i)}$

| | | |
|-----|---------------------------|--|
| (a) | Series Name | VE: VE Series |
| (b) | Nominal Voltage | Refer to the COIL DATA CHART |
| (c) | Contact Rating | H : Heavy duty type |
| (d) | Contact Arrangement | Nil : 1 form C (SPDT) M : 1 form A (SPST-NO) |
| (e) | Coil Type | Nil : Standard type S : High sensitivity type |
| (f) | Contact Material (Rating) | Nil : Gold overlay silver-nickel (N.C.: 3 A, N.O.: 5 A) E : Silver-nickel (N.C.: 3 A, N.O.: 5 A) 5 : Silver alloy (N.C.: 5 A, N.O.: 5 A) |
| (g) | Enclosure | K : Plastic sealed type |
| (h) | Surge Strength | Nil : Standard type (4,000 V) HV: High dielectric strength type (6,000 V) |
| (i) | Standard | VD: UL, CSA, VDE approved type |

Note: Actual marking omits the hyphen (-) of (*)

VE SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E56140)

C22.2 No. 14 (File No. LR35579)

VDE0435

Please note that UL/CSA ratings may differ from the standard ratings.

| Type | Nominal voltage | Contact rating |
|-----------------|-----------------|---|
| VE-H | 5 to 48 VDC | Normally open: 1/14 HP 125 VAC/250 VAC 5 A 30 VDC/250 VAC, resistive Pilot duty D300 Normally close: 1/14 HP 125 VAC/250 VAC 3 A 30 VDC/250 VAC, resistive Pilot duty D150 |
| VE-HM | 5 to 48 VDC | 1/12 HP 125 VAC/250 VAC 5 A 30 VDC/250 VAC, resistive Pilot duty D300 |
| VE-H5 VE-HM5 | 5 to 48 VDC | Normally open: 1/10 HP 125 VAC/250 VAC 5 A 30 VDC/250 VAC, resistive Pilot duty D300 Normally close: 1/14 HP 125 VAC/250 VAC 5 A 30 VDC/250 VAC, resistive |

VE SERIES

■ SPECIFICATIONS

| Item | | VE-() HME-K VE-() HM-K | VE-() HE-K VE-() H-K | VE-() HM5-K | VE-() H5-K | |
|-------------------------|--|--|---|----------------------------|--------------------|------------------|
| Contact | Arrangement | 1 form A (SPST-NO) | 1 form C (SPDT) | 1 form A (SPST-NO) | 1 form C (SPDT) | |
| | Material | Gold overlay silver alloy | | Silver-cadmium oxide alloy | | |
| | Style | Single | | | | |
| | Resistance (initial) (at 1 A 6 VDC) | Maximum 70 mΩ (VE-HM, H) Maximum 100 mΩ (VE-HME, HE) | | Maximum 200 mΩ | | |
| | Rating (resistive) | 5 A 250 VAC | 5 A 250 VAC (N.O.) 3 A 250 VAC (N.C.) | 5 A 250 VAC | | |
| | Maximum Carrying Current | 7 A | | | | |
| | Maximum Switching Power | 1,250 VA | 1,250 VA (N.O.) 750 VA (N.C.) | 1,250 VA | | |
| | Maximum Switching Voltage | 250 VAC, 150 VDC | | | | |
| | Maximum Switching Current | 5 A | 5 A (N.O.) 3 A (N.C.) | 5 A | | |
| | Coil | Minimum Switching Load*1 | 10 mA, 5 VDC (VE-HM, H), 100 mA 5 VDC (VE-HME, HE, HM5, H5) | | | |
| Nominal Power (at 20°C) | | Standard type: 0.36 W. High sensitivity type: 0.25 W | | | | |
| Operate Power (at 20°C) | | Standard type: 0.177 W. High sensitivity type: 0.13 W | | | | |
| Operating Temperature | | Standard: -40°C to +85°C. High sensitivity: -40°C to +90°C (no frost) | | | | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | | | | |
| | Release (at nominal voltage) | Maximum 5 ms | | | | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | | | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute | 750 VAC 1 minute | 1,000 VAC 1 minute | 750 VAC 1 minute |
| | | between coil and contacts | 2,000 VAC 1 minute | | | |
| Surge Strength | Standard type: 4,000 V (at 2 x 10 μs) High dielectric strength type: 6,000 V (at 2 x 10 μs) | | | | | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | | | | |
| | Electrical (at Rating) | Standard Type: 100 x 10 ³ ops. min. High sensitivity type: 50 x 10 ³ ops. min. | | | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 3.3 mm) | | | |
| | | Endurance | 10 to 55 Hz (double amplitude of 3.3 mm) | | | |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ±1 ms) | | | |
| | | Endurance | 500 m/s ² (6 ±1 ms) | | | |
| Weight | Approximately 8 g | | | | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

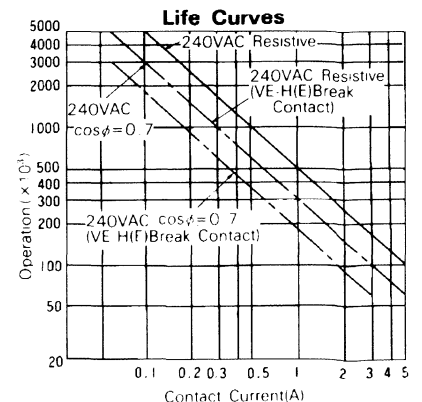
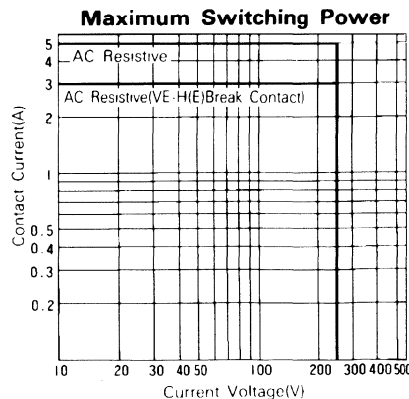
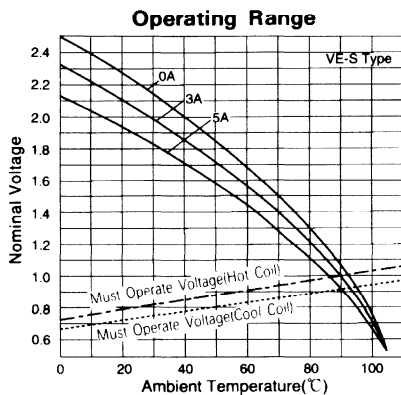
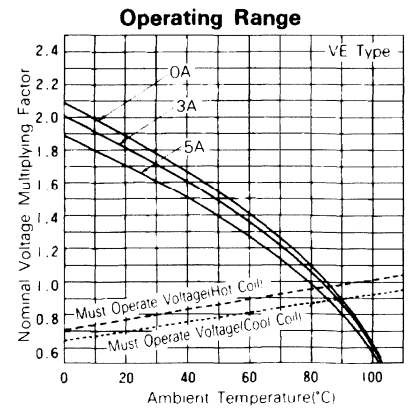
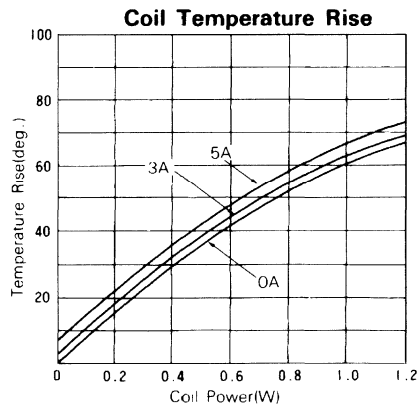
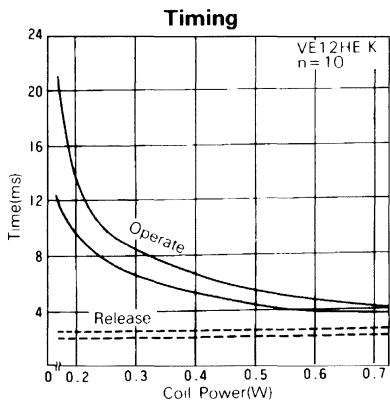
VE SERIES

COIL DATA CHART

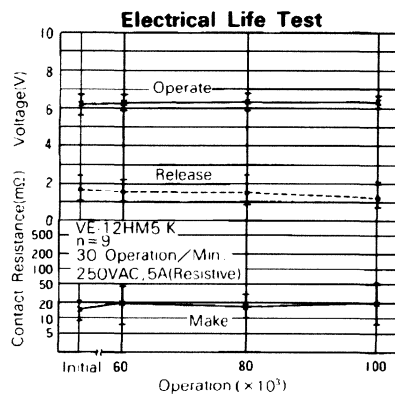
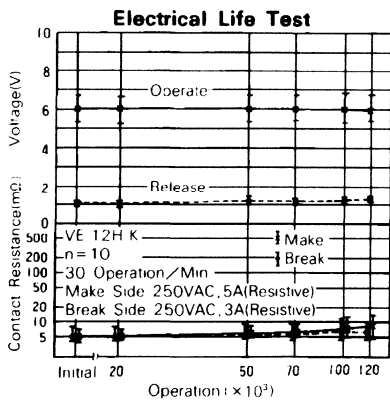
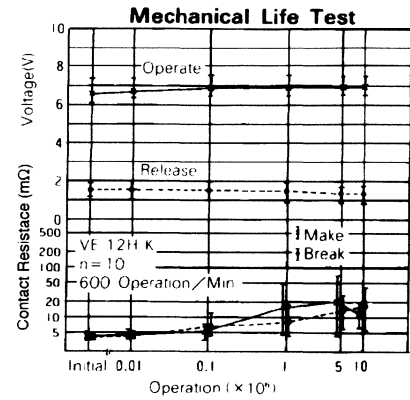
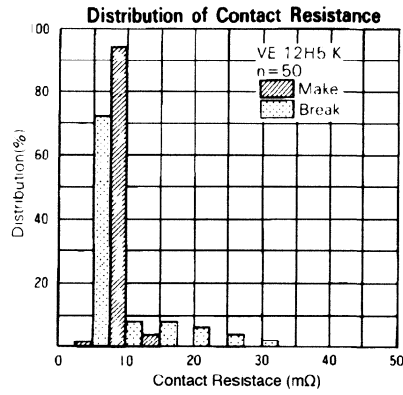
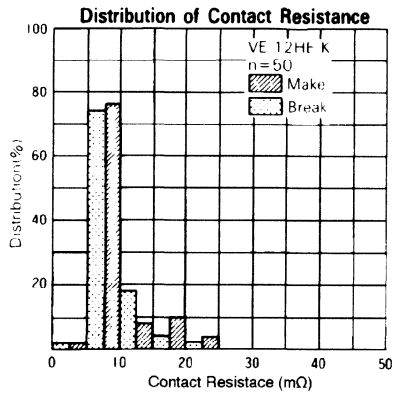
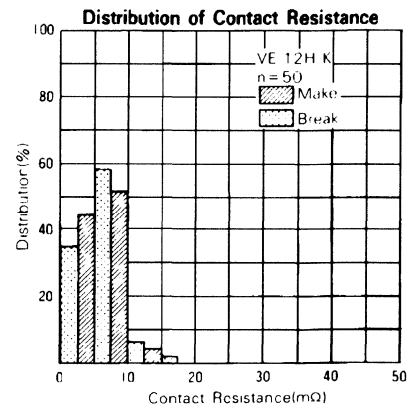
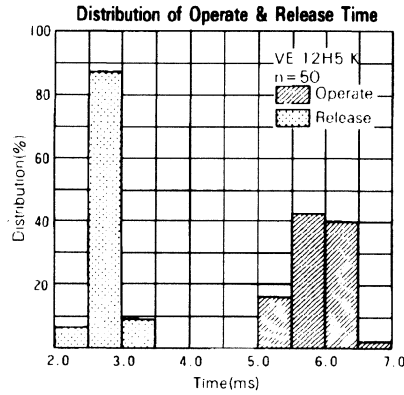
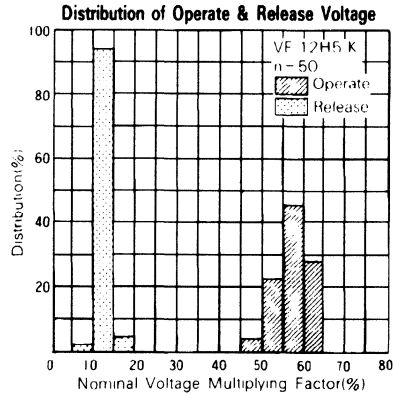
| | MODEL | | Nominal voltage | Coil resistance ($\pm 10\%$) | Must operate voltage | Must release voltage | Nominal power |
|---------------------|-----------------------|-------------------------|-----------------|--------------------------------|----------------------|----------------------|---------------|
| | VE-() HM VE-() H | VE-() HME VE-() HE | | | | | |
| Standard Type | VE- 5H (M) (E)-K | VE- 5H (M) (E) 5-K | 5 VDC | 69 Ω | 3.5 VDC | 0.25 VDC | 360 mW |
| | VE- 6H (M) (E)-K | VE- 6H (M) (E) 5-K | 6 VDC | 100 Ω | 4.2 VDC | 0.3 VDC | 360 mW |
| | VE- 9H (M) (E)-K | VE- 9H (M) (E) 5-K | 9 VDC | 225 Ω | 6.3 VDC | 0.45 VDC | 360 mW |
| | VE-12H (M) (E)-K | VE-12H (M) (E) 5-K | 12 VDC | 400 Ω | 8.4 VDC | 0.6 VDC | 360 mW |
| | VE-18H (M) (E)-K | VE-18H (M) (E) 5-K | 18 VDC | 900 Ω | 12.6 VDC | 0.9 VDC | 360 mW |
| | VE-24H (M) (E)-K | VE-24H (M) (E) 5-K | 24 VDC | 1,600 Ω | 16.8 VDC | 1.2 VDC | 360 mW |
| | VE-48H (M) (E)-K | VE-48H (M) (E) 5-K | 48 VDC | 6,400 Ω | 33.6 VDC | 2.4 VDC | 360 mW |
| High Sensitive Type | VE- 5H (M) S (E)-K | VE- 5H (M) S5-K | 5 VDC | 100 Ω | 3.6 VDC | 0.25 VDC | 250 mW |
| | VE- 6H (M) S (E)-K | VE- 6H (M) S5-K | 6 VDC | 145 Ω | 4.3 VDC | 0.3 VDC | 250 mW |
| | VE- 9H (M) S (E)-K | VE- 9H (M) S5-K | 9 VDC | 325 Ω | 6.5 VDC | 0.45 VDC | 250 mW |
| | VE-12H (M) S (E)-K | VE-12H (M) S5-K | 12 VDC | 575 Ω | 8.6 VDC | 0.6 VDC | 250 mW |
| | VE-18H (M) S (E)-K | VE-18H (M) S5-K | 18 VDC | 1,300 Ω | 13.0 VDC | 0.9 VDC | 250 mW |
| | VE-24H (M) S (E)-K | VE-24H (M) S5-K | 24 VDC | 2,310 Ω | 17.3 VDC | 1.2 VDC | 250 mW |
| | VE-48H (M) S (E)-K | VE-48H (M) S5-K | 48 VDC | 9,220 Ω | 34.7 VDC | 2.4 VDC | 250 mW |

Note: All values in the table are measured at 20 °C.

CHARACTERISTIC DATA



■ REFERENCE DATA

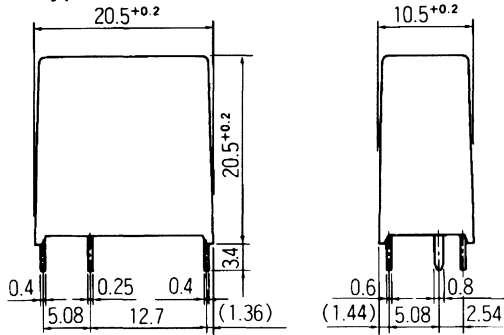


VE SERIES

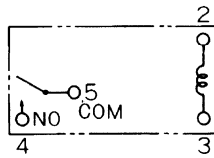
■ DIMENSIONS

● Dimensions

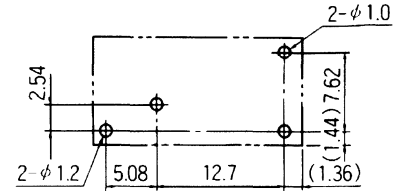
VE-M type



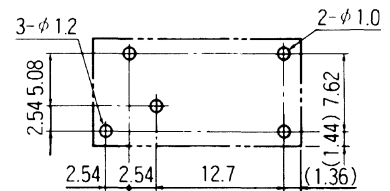
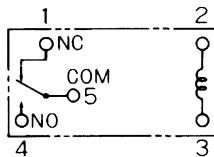
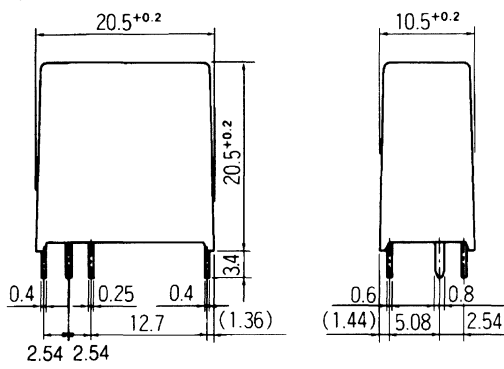
● Schematics (BOTTOM VIEW)



● PC board mounting hole layout (BOTTOM VIEW)



VE type



Unit: mm

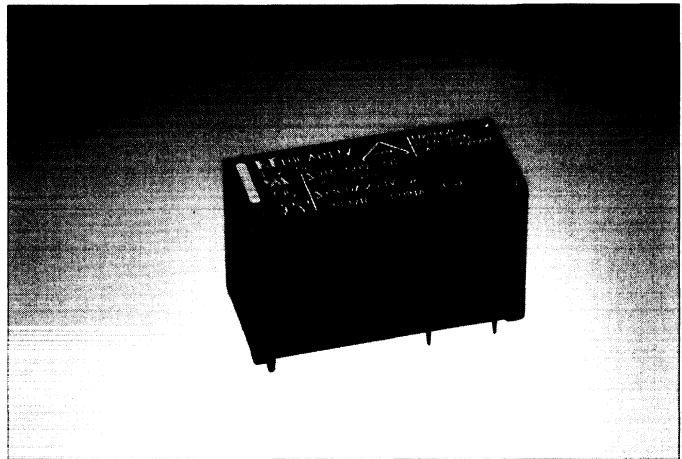
POWER RELAY

1 POLE—10 A LOW PROFILE TYPE

FTR-H1 SERIES

■ FEATURES

- Working class: B (for IMQ)/ C (for VDE)
- Type of service: continuous duty
- Low profile (height 16.5 mm)/ cadmium free contacts
- 1 form A/ 1 form C 10 A, TV-5 rating available
- UL class B (130°C) insulation
 - Insulation distance : 8 mm
 - Dielectric strength : 5,000 VAC
 - Surge strength : 10,000 V
- Plastic materials —UL94 flame class V-0
UL CTI level class 2
- Plastic sealed relay backfilled with nitrogen
- Pin configuration compatible to VS/ FBR610 Series
- UL, CSA, BSI, VDE, SEMKO recognized
- Conforms to IMQ, FIMKO, DEMKO
- Environmentally friendly cadmium free contacts type are available



■ ORDERING INFORMATION

[Example] $\frac{\text{FTR-H1}}{\text{(a)}} \frac{\text{A}}{\text{(b)}} \frac{\text{A}}{\text{(c)}} \frac{\text{005}}{\text{(d)}} \frac{\text{V}}{\text{(e)}} \frac{\text{-**}}{\text{(f)}}$

| | | | | | |
|-----|--------------------------|-------------------------------------|---|-----|----------|
| (a) | Series Name | FTR-H1: FTR-H1 Series | | | |
| (b) | Contact Arrangement | A | : 1 form A (SPST-NO) | | |
| | | C | : 1 form C (SPDT) | | |
| (c) | Coil Type | A | : Standard type (0.53 W) | | |
| | | D | : High sensitive type (0.4W) | | |
| (d) | Nominal Voltage | 005 | : 5 VDC | 012 | : 12 VDC |
| | | 006 | : 6 VDC | 024 | : 24 VDC |
| | | 009 | : 9 VDC | 048 | : 48 VDC |
| (e) | Contact Material/TV Type | V | : Gold plate silver alloy (standard type) | | |
| | | T | : Gold plate silver alloy (TV-5 rating type, 1 form A standard type only) | | |
| (f) | Custom Designation | Custom specification to be assigned | | | |

Ordering Code Actual Marking
FTR-H1AA005V H1AA005V

FTR-H1 SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E63614)

C22.2 No. 14 (File No. LR40304-30/LR107822)

VDE 0435, 0631, 0700, 0860


| | Nominal voltage | Contact rating |
|-----------|------------------------|--|
| TV-Rating | 5 ~ 48 VDC | TV-5 120 VAC 1/2 HP 250 VAC 1/3 HP 125 VAC 10 A 30 VDC/250 VAC resistive Pilot duty B 300, Q 300 |
| General | | 1/2 HP 250 VAC 1/3 HP 125 VAC 10 A 30 VDC/250 VAC resistive 3A 250 VAC inductive (PF=0.4) Pilot duty B 300, Q 300 |

FTR-H1 SERIES

■ SPECIFICATIONS

| Item | | Standard Type | Sensitive | TV-5 Rating Type |
|------------|------------------------------|--|--|--------------------------------------|
| Contact | Arrangement | 1 form A (SPST-NO), 1 form C (SPDT) | | 1 form A (SPST-NO) |
| | Material | Gold plate silver alloy | | |
| | Style | Single | | |
| | Resistance (initial) | Maximum 100 mΩ (at 1 A 6 VDC) | | |
| | Rating (Resistive) | 10 A 250 VAC/30 VDC | | |
| | Maximum Carrying Current | 14 A | | |
| | Maximum Switching Rating | 2,500 VA/300 W | | |
| | Maximum Switching Voltage | 380 VAC 300 VDC | | |
| | Maximum Switching Current | 10 A | | |
| | Minimum Switching Load*1 | 10 mA 5 VDC | | |
| | Maximum Inrush Current | — | 78 A 120VAC (at lamp load) | |
| Coil | Operating Range | 80 to 110 % x V nominal | | |
| | Nominal Power (at 20°C) | 0.53 W | 0.4W | 0.53 W |
| | Operate Power (at 20°C) | 0.26 W | 0.225W | 0.26W |
| Time Value | Operating Temperature | -40°C to +75°C (no frost) (refer to the CHARACTERISTIC DATA) | | |
| | Operate (at nominal voltage) | Maximum 10 ms | | |
| | Release (at nominal voltage) | Maximum 5 ms | | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | |
| | Dielectric Strength | Between open contacts | 1,000 VAC 1 minute | |
| | | Between coil and contacts*2 | 5,000 VAC 1 minute | |
| | Surge Strength*3 | 10,000 V (at 1.2 x 50 μs) | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | |
| | Electrical | Contact Rating | 100 x 10 ³ operations minimum | |
| | | Lamp Load | — | 25 x 10 ³ operations min. |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.65 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 3.3 mm) | |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ± ¹ ms) | |
| | | Endurance | 1,000 m/s ² (6 ± ¹ ms) | |
| | Weight | Approximately 12 g | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

*2 IMQ 

*3 IMQ 

FTR-H1 SERIES

■ COIL DATA CHART

| MODEL | | Nominal Voltage | Coil Resistance (±10%) | Must Operate Voltage | Must Release Voltage |
|----------------------|------------------|-----------------|------------------------|----------------------|----------------------|
| Standard Type | TV-5 Rating Type | | | | |
| FTR-H1 (C, A) A005 V | FTR-H1AA005 T | 5 VDC | 47 Ω | 3.5 VDC | 0.5 VDC |
| FTR-H1 (C, A) A006V | FTR-H1AA006 T | 6 VDC | 68 Ω | 4.2 VDC | 0.6 VDC |
| FTR-H1 (C, A) A009 V | FTR-H1AA009 T | 9 VDC | 155 Ω | 6.3 VDC | 0.9 VDC |
| FTR-H1 (C, A) A012 V | FTR-H1AA012 T | 12 VDC | 270 Ω | 8.4 VDC | 1.2 VDC |
| FTR-H1 (C, A) A024 V | FTR-H1AA024 T | 24 VDC | 1,100 Ω | 16.8 VDC | 2.4 VDC |
| FTR-H1 (C, A) A048 V | FTR-H1AA048 T | 48 VDC | 4,400 Ω | 33.6 VDC | 4.8 VDC |

Note: All values in the table are measured at 20°C.

Sensitive Type

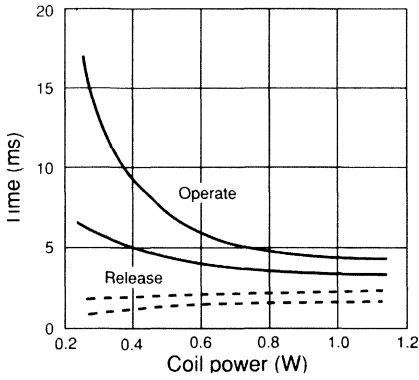
| MODEL | | Nominal Voltage | Coil Resistance (±10%) | Must Operate Voltage | Must Release Voltage |
|----------------------|--|-----------------|------------------------|----------------------|----------------------|
| Standard Type | | | | | |
| FTR-H1 (C, A) D005 V | | 5 VDC | 62 Ω | 3.75 VDC | 0.5 VDC |
| FTR-H1 (C, A) D006 V | | 6 VDC | 90 Ω | 4.5 VDC | 0.6 VDC |
| FTR-H1 (C, A) D009V | | 9 VDC | 202 Ω | 6.75 VDC | 0.9 VDC |
| FTR-H1 (C, A) D012 V | | 12 VDC | 360 Ω | 9.0 VDC | 1.2 VDC |
| FTR-H1 (C, A) D024 V | | 24 VDC | 1,440 Ω | 18.0 VDC | 2.4 VDC |
| FTR-H1 (C, A) D048 V | | 48 VDC | 5,760 Ω | 36.0 VDC | 4.8 VDC |

Note: All values in the table are measured at 20°C.

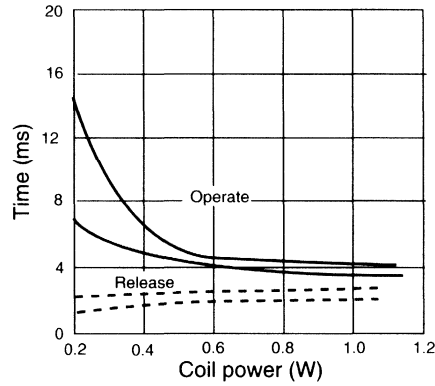
FTR-H1 SERIES

CHARACTERISTIC DATA

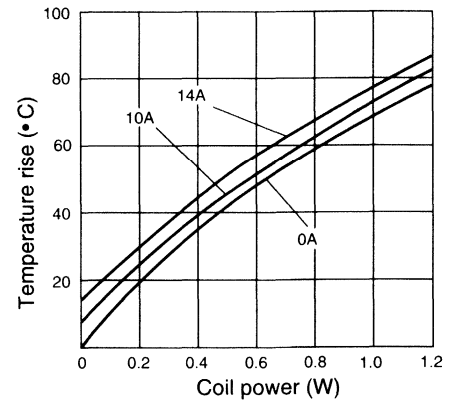
Timing



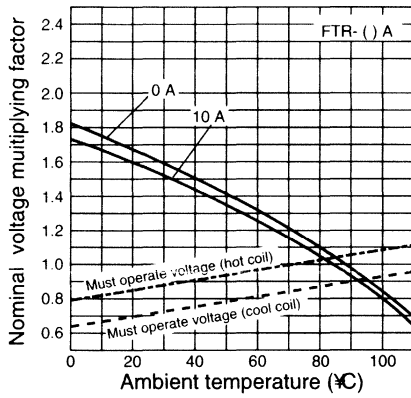
Timing



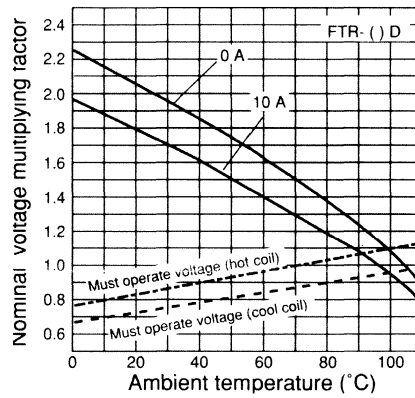
Coil temperature rise



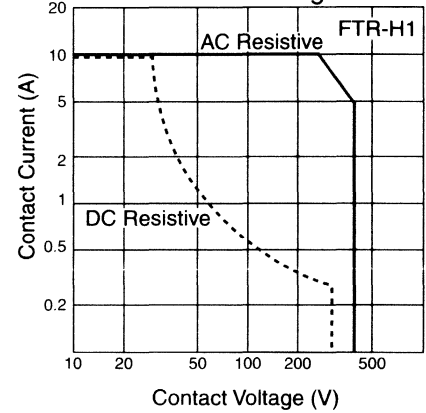
Operating range



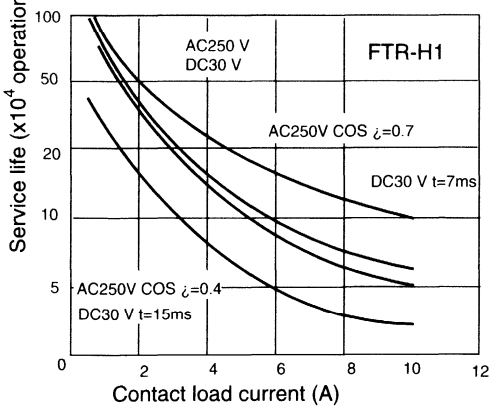
Operating range



Maximum Switching Power



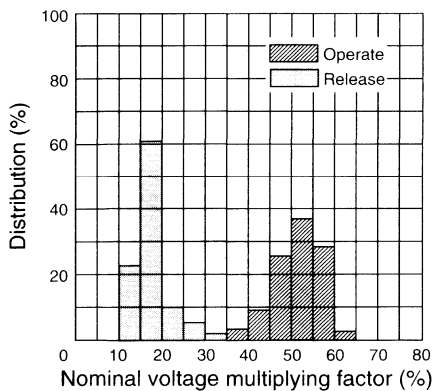
Life Curve



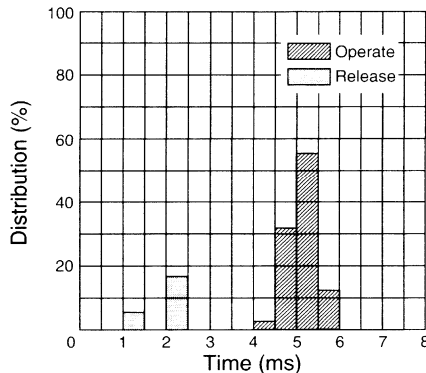
FTR-H1 SERIES

REFERENCE DATA

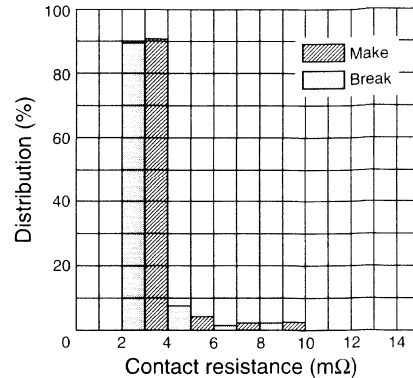
Distribution of operate and release voltage



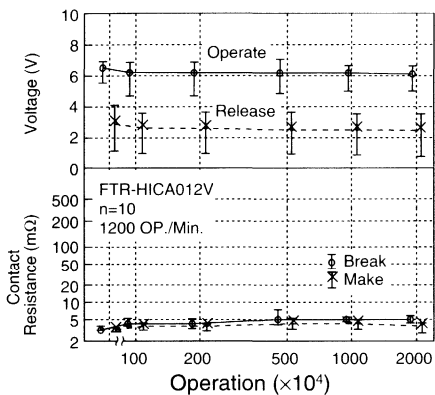
Distribution of operate and release time



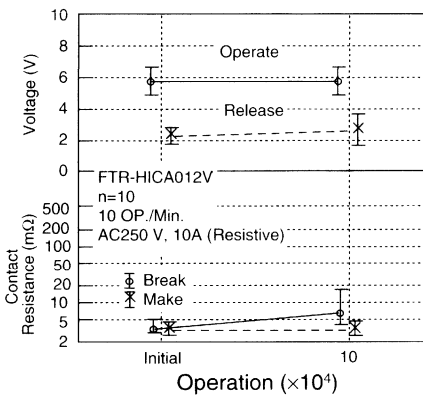
Distribution of contact resistance



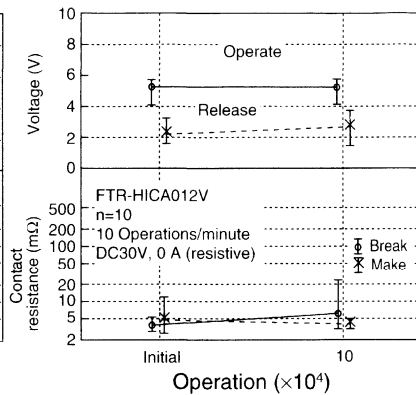
Mechanical life test



Electrical life test



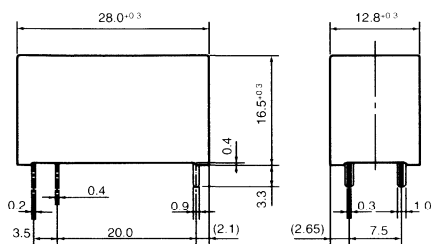
Electrical life test



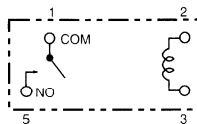
DIMENSIONS

Dimensions

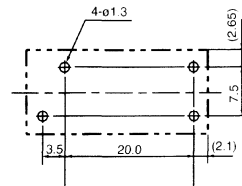
FTR-H1A type



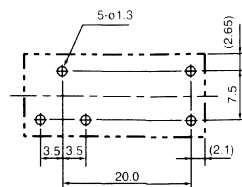
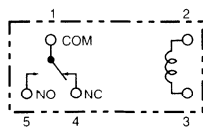
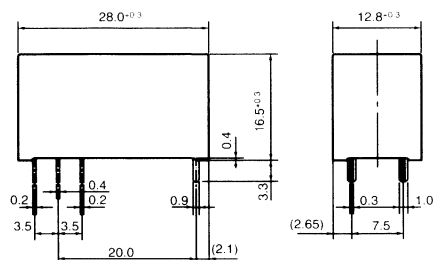
Schematics (BOTTOM VIEW)



PC board mounting hole layout (BOTTOM VIEW)



FTR-H1C type



Unit: mm

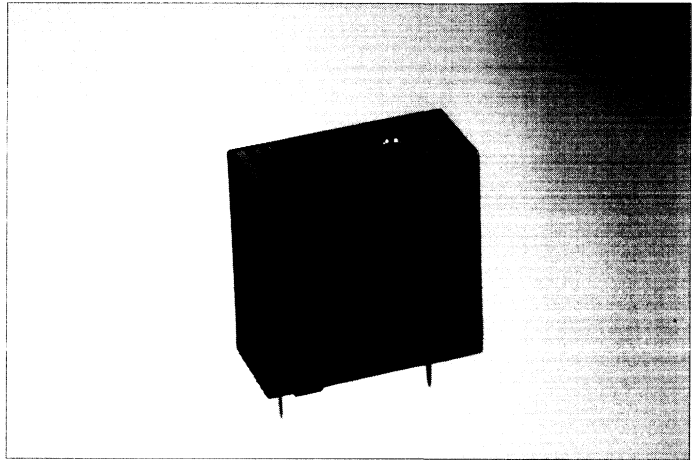
POWER RELAY

10A/TV-5 RATED COMPACT TYPE

FTR-H2 SERIES

■ FEATURES

- HIGH DENSITY MOUNTING
Saves space by 26% compared to FTR-H1 type
- HIGH ISOLATION
Insulation distance: minimum 6mm between coil and contact (conforms to IEC 65)
Dielectric strength: 4 kV
Surge strength: 10 kV
- HIGH NOISE RESISTANCE
Uses card separation for high noise resistance between coil and contact
- HEAT RESISTANCE, FLAMMABILITY 94V-0
- CADMIUM FREE CONTACT FOR ECO-PROGRAM
- SAFTY STANDARDS
UL, CSA, VDE approved (SEMKO pending)
UL, CSA TV-5 rating approved



■ ORDERING INFORMATION

[Example] $\frac{\text{FTR-H2}}{\text{(a)}} \quad \frac{\text{A}}{\text{(b)}} \quad \frac{\text{K}}{\text{(c)}} \quad \frac{\text{012}}{\text{(d)}} \quad \frac{\text{T}}{\text{(e)}} \quad \frac{\text{- **}}{\text{(f)}}$

| | | |
|-----|---------------------|--|
| (a) | Series Name | FTR-H2: FTR-H2 Series |
| (b) | Contact Arrangement | A : 1 form A |
| (c) | Coil Type | K : Standard type (530 mW) L : Sensitive type (250mW) |
| (d) | Nominal Voltage | 005 : 5 VDC, 006 : 6VDC, 009 : 9VDC 012 : 12VDC, 024 : 24VDC, 048 : 48VDC |
| (e) | TV-Rating | T : TV-5 |
| (f) | Custom Designation | Special number for customized products |

Actual marking does not carry the type name : "FTR"
E.g.: Ordering code: FTR-H 2AK012T Actual marking: H2AK012T

FTR-H2 SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E63615)

C22.2 No.1 and No. 14 (File No. LR40304)

VDE 0435, 0860

| | Nominal voltage | Contact rating |
|-------------|-----------------|---|
| FTR-H2AK() | 5 ~ 48 VDC | TV-5 120 VAC 1/2 HP 250 VAC 1/6 HP 125 VAC 10 A 30 VDC/250 VAC resistive 3A 250VAC inductive (PF=0.4) Pilot duty C300 |
| FTR-H2AL() | 5 ~ 48 VDC | |

FTR-H2 SERIES

■ SPECIFICATIONS

| Item | | FTR-H2 | |
|----------------|---|--|--|
| | | Standard Type | Sensitive Type |
| Contact | Arrangement | 1 form A (SPST-NO) | |
| | Material | Silver alloy | |
| | Style | Single | |
| | Resistance (initial) | Maximum 100 mΩ (at 1 A 6 VDC) | |
| | Rating (resistive) | 10A, 250 VAC/30 VDC | |
| | Maximum Carrying Current | 10 A | |
| | Maximum Switching Power | 2500 VA/300 W | |
| | Maximum Switching Voltage | 400 VAC/300 VDC | |
| | Minimum Switching Load* ¹ | 100 mA 5 VDC | |
| | Maximum Inrush Current | 120 VAC, 78A (TV-5) | |
| Coil | Nominal Power(at 20°C) | 530mW | 250mW |
| | Operate Power (at 20°C) | 260mW | 160mW |
| | Operating Temperature | -40°C to +70°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 15 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute |
| | | between coil and contacts | 4,000 VAC 1 minute |
| Surge Strength | 10,000 V (at 1.2 x 50 μs)(between coil and contact) | | |
| Life | Mechanical | 2 x 10 ⁶ operations minimum | |
| | Electrical | Contact rating | 100 x 10 ³ operations minimum (at contact rating) |
| | | Lamp load | 25 x 10 ³ operations minimum |
| Vibration | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | Endurance | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| Shock | Misoperation | 200 m/s ² (11 ±1 ms) | |
| | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| Weight | | Approximately 12 g | |

*¹ Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

FTR-H2 SERIES

COIL DATA CHART

Standard type

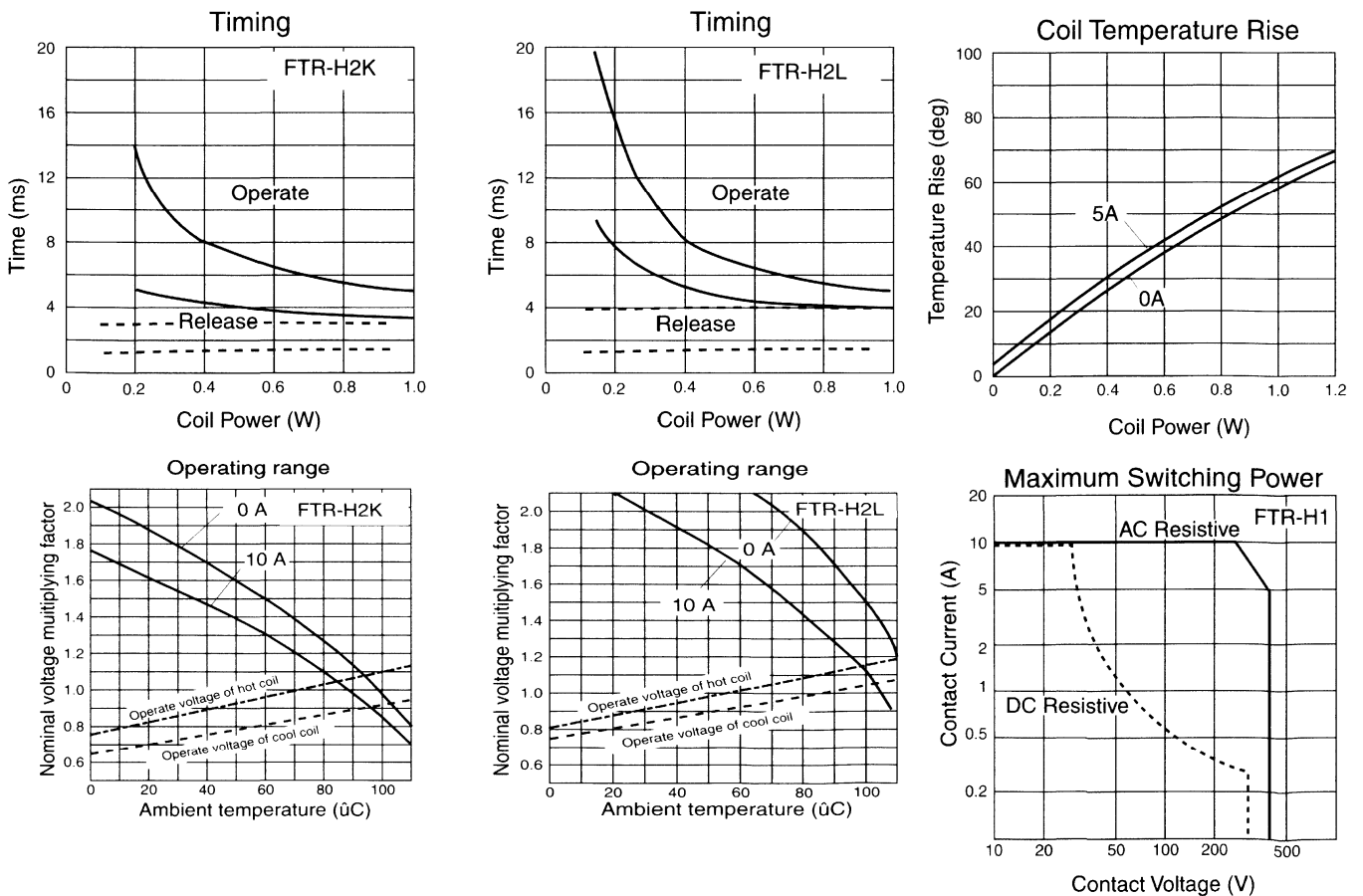
| MODEL | Nominal voltage | Coil resistance | Operate voltage | Release voltage | Nominal power |
|--------------|-----------------|-----------------|-----------------|-----------------|---------------|
| FTR-H2AK005T | 5VDC | 47 Ω | 3.5 VDC | 0.25 VDC | 530mW |
| FTR-H2AK006T | 6VDC | 68 Ω | 4.2 VDC | 0.3 VDC | 530mW |
| FTR-H2AK009T | 9VDC | 155 Ω | 6.3 VDC | 0.45 VDC | 530mW |
| FTR-H2AK012T | 12VDC | 270 Ω | 8.4 VDC | 0.6 VDC | 530mW |
| FTR-H2AK024T | 24VDC | 1,100 Ω | 16.8 VDC | 1.2 VDC | 530mW |
| FTR-H2AK048T | 48VDC | 4,400 Ω | 33.6 VDC | 2.4 VDC | 530mW |

Sensitive type

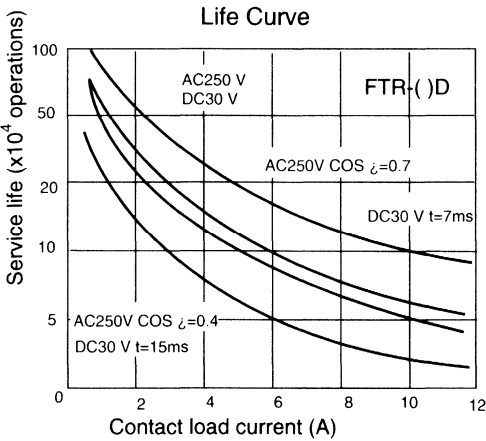
| MODEL | Nominal voltage | Coil resistance | Operate voltage | Release voltage | Nominal power |
|--------------|-----------------|-----------------|-----------------|-----------------|---------------|
| FTR-H2AL005T | 5VDC | 100 Ω | 4.0 VDC | 0.25 VDC | 250mW |
| FTR-H2AL006T | 6VDC | 145 Ω | 4.8 VDC | 0.3 VDC | 250mW |
| FTR-H2AL009T | 9VDC | 325 Ω | 7.2 VDC | 0.45 VDC | 250mW |
| FTR-H2AL012T | 12VDC | 575 Ω | 9.6 VDC | 0.6 VDC | 250mW |
| FTR-H2AL024T | 24VDC | 2,310 Ω | 19.2 VDC | 1.2 VDC | 250mW |

Note: All values in the table are measured at 20°C.

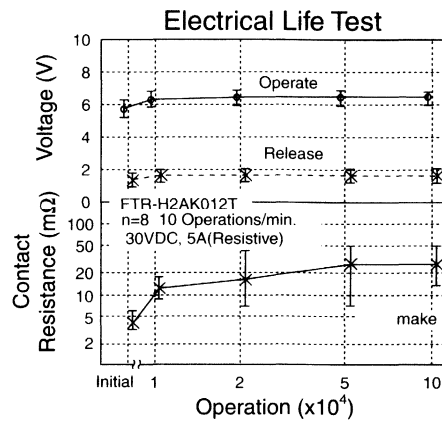
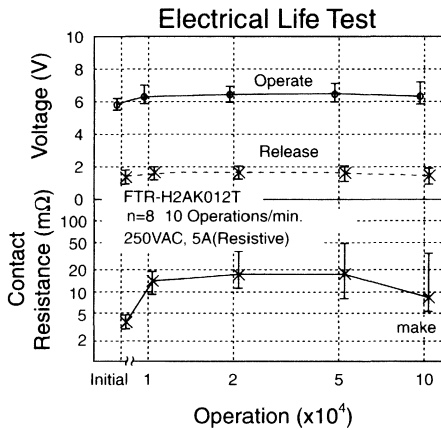
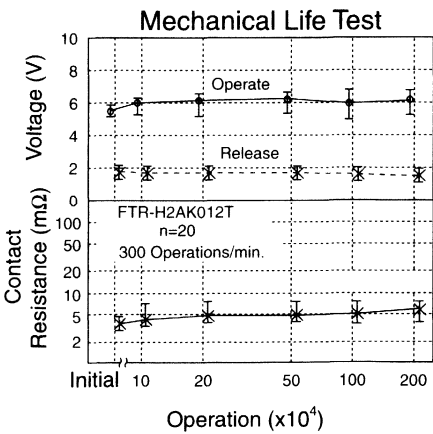
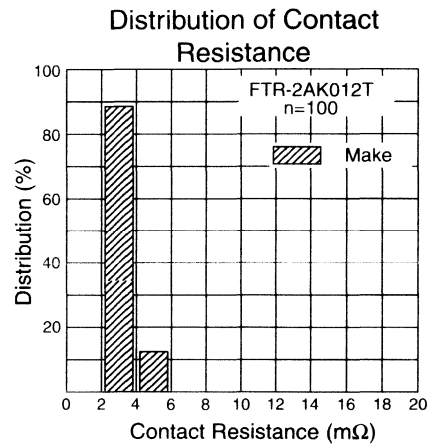
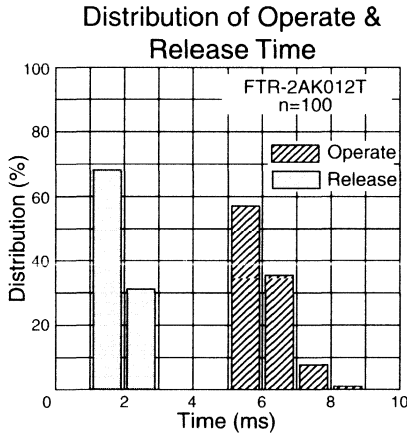
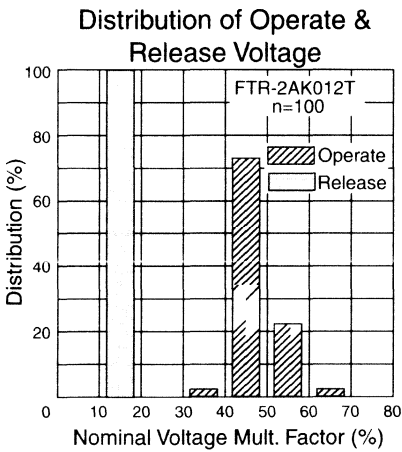
CHARACTERISTIC DATA



FTR-H2 SERIES



REFERENCE DATA

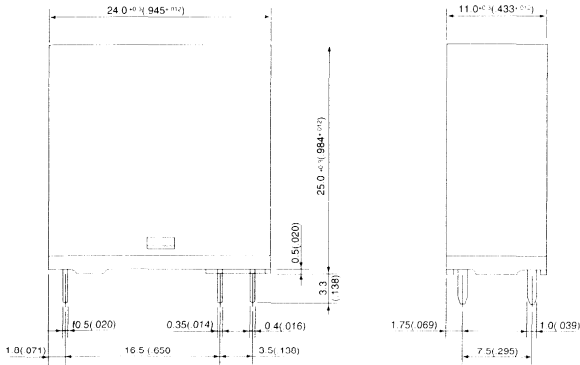


FTR-H2 SERIES

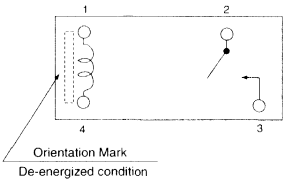
■ DIMENSIONS

● Dimensions

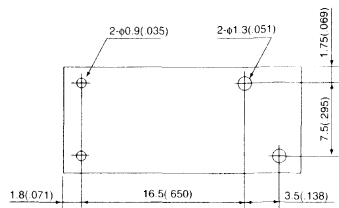
FTR-H2 type



● Schematics (BOTTOM VIEW)



● PC board mounting hole layout (BOTTOM VIEW)



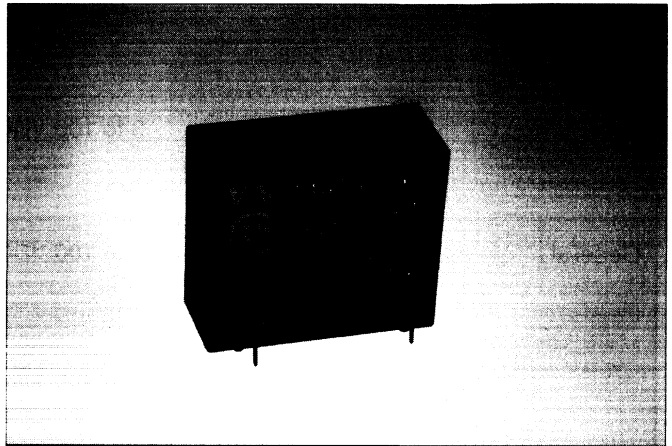
Unit: mm

POWER RELAY

1 POLE—10, 15 A (HEAVY POWER CONTROL) VS SERIES

■ FEATURES

- UL, CSA, VDE, SEV, SEMKO, FIMKO, IMQ recognized TV-5, TV-8 rated
- Working class: C
- UL class B (130°C) insulation
- Type of service: continuous duty
- Heavy duty miniature slim type power relay
- High isolation in small package
 - Insulation distance: 8 mm
 - Dielectric strength: 5,000 VAC (between coil and contacts)
 - Surge strength: 10,000 V
- Standard and high sensitivity types available
- Flux free type and plastic sealed type available



■ ORDERING INFORMATION

[Example] $\frac{VS}{(a)}$ - $\frac{12}{(*)}$ $\frac{S}{(b)}$ $\frac{M}{(c)}$ $\frac{B}{(d)}$ $\frac{U}{(e)}$ - $\frac{NR}{(f)}$ $\frac{NR}{(g)}$

| | | |
|-----|---------------------|---|
| (a) | Series Name | VS: VS Series |
| (b) | Nominal Voltage | Refer to the COIL DATA CHART |
| (c) | Coil Type | Nil : Standard type S : High sensitivity type (not available with TV-8 type) |
| (d) | Contact Arrangement | T : 1 form C (SPDT) (non VS-NR type) M : 1 form A (SPST-NO) |
| (e) | Enclosure | B : Flux free type C : Plastic sealed type (with tape) K : Plastic sealed type |
| (f) | Standard | Nil : TV rating type U : Non TV rating type (standard type) |
| (g) | Contact Material | NR: Silver alloy (TV-8 rating type) Nil : Silver-cadmium oxide (TV-5 rating type) 5 : Silver-cadmium oxide (non TV rating) Nil : Gold overlay silver-nickel (non TV rating) E : Silver-nickel (non TV rating) |

Note: Actual marking omits the hyphen (-) of (*)

VS SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL508, (File No. E56140, E108658)

C22.2 No. 1, No. 14 (File No. LR35579)

VDE0435, 0630, 0631, 0700, 0860

Please note that UL/CSA ratings may differ from the standard ratings.

Please request when the approval markings are required on the cover and/or relay recognized by VDE, SEV, SEMKO, FIMKO, IMQ is required.

| | Type | Nominal voltage | Contact rating |
|-----------|---------------------------------|-----------------|---|
| TV-Rating | VS-()M-NR | 3 to 100 VDC | TV-8 120 VAC 1/3 HP 120 VAC/240 VAC 15 A 24 VDC/120 VAC resistive 10 A 240 VAC resistive Pilot duty B 150 |
| | VS-()M VS-()SM | 3 to 100 VDC | TV-5 120 VAC 1/3 HP 120 VAC/240 VAC 10 A 24 VDC/240 VAC resistive Pilot duty C 150 |
| General | VS-()MU-NR VS-()SMU-NR | 3 to 100 VDC | 1/3 HP 120 VAC/240 VAC 15 A 24 VDC/120 VAC resistive 10 A 240 VAC resistive Pilot duty B 150 |
| | VS-()()U-NR VS-()S()U-NR | 3 to 100 VDC | 1/3 HP 120 VAC/240 VAC 10 A 24 VDC/240 VAC resistive Pilot duty C 150 |

VS SERIES

■ SPECIFICATIONS

| Item | | TV-8 Rating Type | TV-5 Rating Type | Standard Type | |
|------------|--------------------------------------|---|--|---|---|
| | | VS-()M-NR | VS-()M | VS-()-5 | VS-() VS-()-E |
| Contact | Arrangement | 1 form A (SPST-NO) | | 1 form A (SPST-NO) or 1 form C (SPDT) | |
| | Material | Silver alloy | Silver-cadmium oxide | | Gold overlay silver-nickel (non gold overlay: only VS-E) |
| | Style | Single | | | |
| | Resistance (initial) (at 1 A 6 VDC) | Maximum 200 mΩ | | | Maximum 100 mΩ |
| | Rating (resistive) | 15 A 240 VAC/24 VDC | 10 A 240 VAC/24 VDC | | |
| | Maximum Carrying Current | 15 A | 10A | | |
| | Maximum Switching Power | 3,600 VA/360 W | 2,400 VA/240 W | | |
| | Maximum Switching Voltage | 380 VAC, 150 VDC | | | |
| | Maximum Switching Current | 15 A | 10 A | | |
| | Minimum Switching Load* ¹ | 100 mA 5 VDC (VS-NR, M, 5, E), 10 mA 5 VDC (VS-) | | | |
| | Max. Inrush Current (at lamp load) | 117 A 120 VAC | 78 A 120 VAC | — | |
| Coil | Nominal Power (at 20°C) | Standard type: 0.7 to 0.75 W. High sensitivity type: 0.53 W | | | |
| | Operate Power (at 20°C) | Standard type: 0.35 to 0.37 W. High sensitivity type: 0.26 W | | | |
| | Operating Temperature | Standard type: -40°C to +65°C. High sensitivity type: -40°C to +75°C (no frost) | | | |
| Time Value | Operate (at nominal voltage) | Maximum 20 ms | | | |
| | Release (at nominal voltage) | Maximum 10 ms | | | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute | | |
| | | between coil and contacts* ² | 5,000 VAC 1 minute | | |
| | Surge Strength* ³ | 10,000 V (at 1.2 x 50 μs) | | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | | |
| | Electrical | 100 x 10 ³ operations minimum (at contact rating, resistive) | | | |
| | | 50 x 10 ³ operations minimum (at 1/4 HP 120 VAC, motor) | | 30 x 10 ³ operations minimum (at 1/4 HP 120 VAC, motor) | |
| | | 25 x 10 ³ ops. min. (at 17 A 120 VAC, lamp) | 50 x 10 ³ ops. min. (at 78A 120 VAC, lamp) | — | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) | | |
| | | Endurance | 10 to 55 Hz (double amplitude of 1.5 mm) | | |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ±1 ms) | | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | | |
| | Weight | Approximately 17 g | | | |

*¹ Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

*² IMQ ☆

*³ IMQ ▽

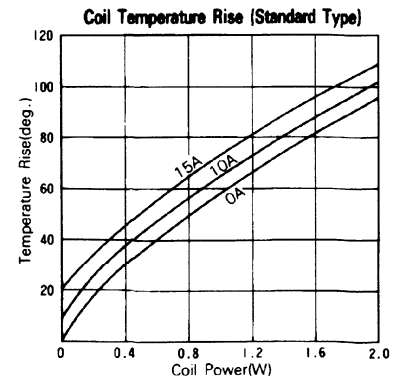
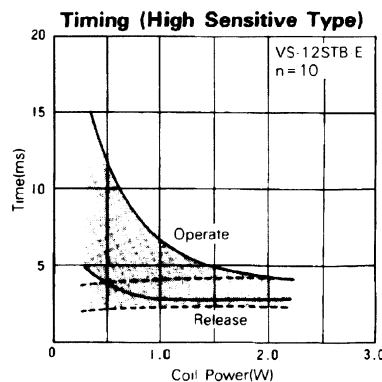
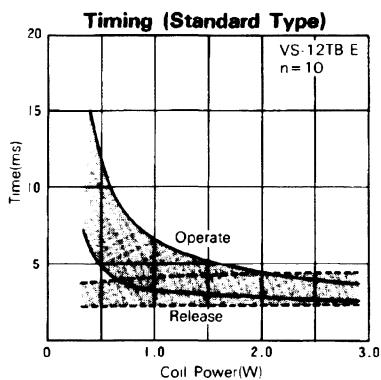
VS SERIES

COIL DATA CHART

| | MODEL | | | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage | Nominal power |
|---------------------|---------------|-------------|---------------|-----------------|-----------------|------------------------|----------------------|----------------------|---------------|
| | TV-8 Rating | TV-5 Rating | Standard | | | | | | |
| | 15 A Type | 10 A Type | 10 A Type | | | | | | |
| Standard Type | VS- 3M()-NR | VS- 3M() | VS- 3()U-5 | VS- 3()U-() | 3 VDC | 12.5 Ω | 2.1 VDC | 0.3 VDC | 0.72 W |
| | VS- 5M()-NR | VS- 5M() | VS- 5()U-5 | VS- 5()U-() | 5 VDC | 36 Ω | 3.5 VDC | 0.5 VDC | 0.70 W |
| | VS- 6M()-NR | VS- 6M() | VS- 6()U-5 | VS- 6()U-() | 6 VDC | 50 Ω | 4.2 VDC | 0.6 VDC | 0.72 W |
| | VS- 9M()-NR | VS- 9M() | VS- 9()U-5 | VS- 9()U-() | 9 VDC | 115 Ω | 6.3 VDC | 0.9 VDC | 0.70 W |
| | VS- 12M()-NR | VS- 12M() | VS- 12()U-5 | VS- 12()U-() | 12 VDC | 200 Ω | 8.4 VDC | 1.2 VDC | 0.72 W |
| | VS- 14M()-NR | VS- 14M() | VS- 14()U-5 | VS- 14()U-() | 14 VDC | 280 Ω | 9.8 VDC | 1.4 VDC | 0.70 W |
| | VS- 18M()-NR | VS- 18M() | VS- 18()U-5 | VS- 18()U-() | 18 VDC | 460 Ω | 12.6 VDC | 1.8 VDC | 0.70 W |
| | VS- 24M()-NR | VS- 24M() | VS- 24()U-5 | VS- 24()U-() | 24 VDC | 820 Ω | 16.8 VDC | 2.4 VDC | 0.70 W |
| | VS- 36M()-NR | VS- 36M() | VS- 36()U-5 | VS- 36()U-() | 36 VDC | 1,850 Ω | 25.2 VDC | 3.6 VDC | 0.70 W |
| | VS- 48M()-NR | VS- 48M() | VS- 48()U-5 | VS- 48()U-() | 48 VDC | 3,300 Ω | 33.6 VDC | 4.8 VDC | 0.70 W |
| | VS- 60M()-NR | VS- 60M() | VS- 60()U-5 | VS- 60()U-() | 60 VDC | 5,100 Ω | 42.0 VDC | 6.0 VDC | 0.70 W |
| | VS-100M()-NR | VS-100M() | VS-100()U-5 | VS-100()U-() | 100 VDC | 13,400 Ω | 70.0 VDC | 10.0 VDC | 0.75 W |
| High Sensitive Type | | VS- 3SM() | VS- 3S()U-5 | VS- 3S()U-() | 3 VDC | 17 Ω | 2.1 VDC | 0.3 VDC | 0.53 W |
| | | VS- 5SM() | VS- 5S()U-5 | VS- 5S()U-() | 5 VDC | 47 Ω | 3.5 VDC | 0.5 VDC | 0.53 W |
| | | VS- 6SM() | VS- 5S()U-5 | VS- 5S()U-() | 6 VDC | 68 Ω | 4.2 VDC | 0.6 VDC | 0.53 W |
| | | VS- 9SM() | VS- 9S()U-5 | VS- 9S()U-() | 9 VDC | 155 Ω | 6.3 VDC | 0.9 VDC | 0.53 W |
| | | VS- 12SM() | VS- 12S()U-5 | VS- 12S()U-() | 12 VDC | 270 Ω | 8.4 VDC | 1.2 VDC | 0.53 W |
| | | VS- 14SM() | VS- 14S()U-5 | VS- 14S()U-() | 14 VDC | 370 Ω | 9.8 VDC | 1.4 VDC | 0.53 W |
| | | VS- 18SM() | VS- 18S()U-5 | VS- 18S()U-() | 18 VDC | 610 Ω | 12.6 VDC | 1.8 VDC | 0.53 W |
| | | VS- 24SM() | VS- 24S()U-5 | VS- 24S()U-() | 24 VDC | 1,100 Ω | 16.8 VDC | 2.4 VDC | 0.53 W |
| | | VS- 36SM() | VS- 36S()U-5 | VS- 36S()U-() | 36 VDC | 2,450 Ω | 25.2 VDC | 3.6 VDC | 0.53 W |
| | | VS- 48SM() | VS- 48S()U-5 | VS- 48S()U-() | 48 VDC | 4,400 Ω | 33.6 VDC | 4.8 VDC | 0.53 W |
| | | VS- 60SM() | VS- 60S()U-5 | VS- 60S()U-() | 60 VDC | 6,800 Ω | 42.0 VDC | 6.0 VDC | 0.53 W |
| | | VS-100SM() | VS-100S()U-5 | VS-100S()U-() | 100 VDC | 18,860 Ω | 70.0 VDC | 10.0 VDC | 0.53 W |

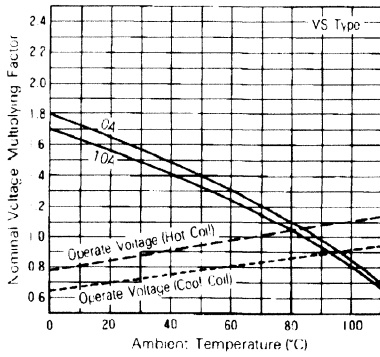
Note: All values in the table are measured at 20°C

CHARACTERISTIC DATA

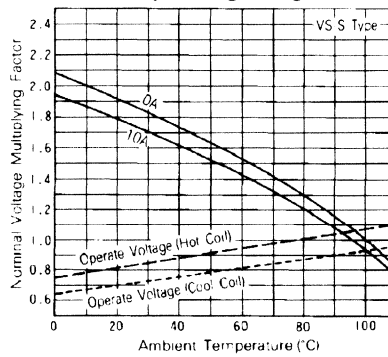


VS SERIES

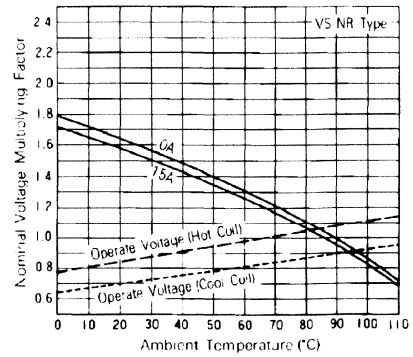
Operating Range



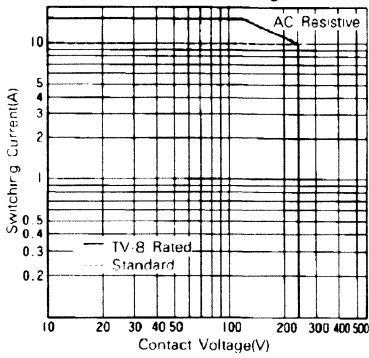
Operating Range



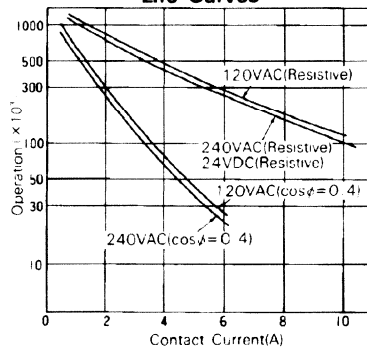
Operating Range



Maximum Switching Power

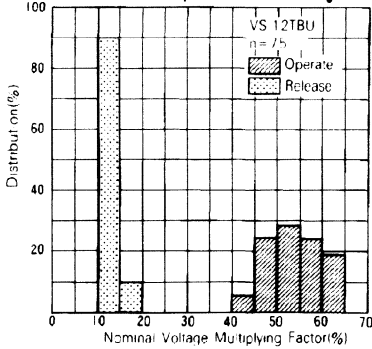


Life Curves

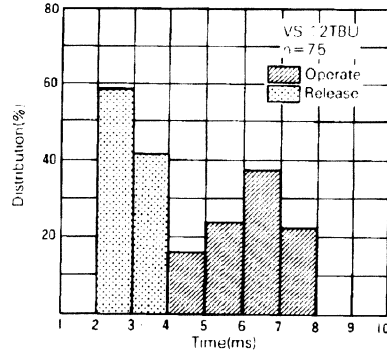


REFERENCE DATA

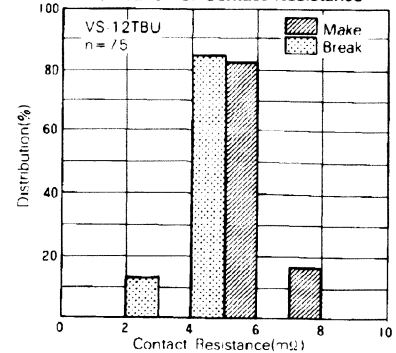
Distribution of Operate & Release Voltage



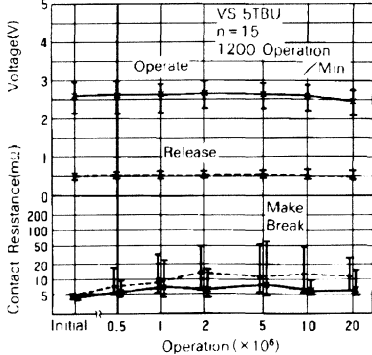
Distribution of Operation & Release Time



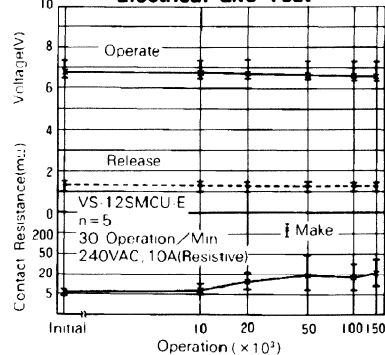
Distribution of Contact Resistance



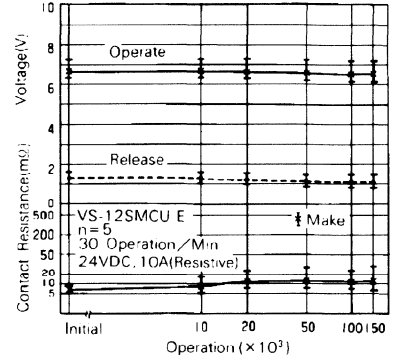
Mechanical Life Test



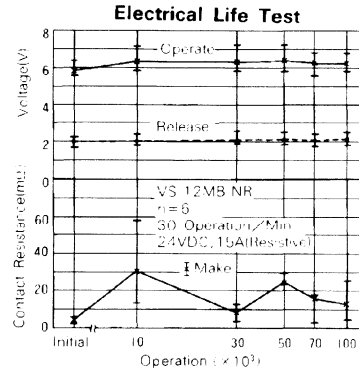
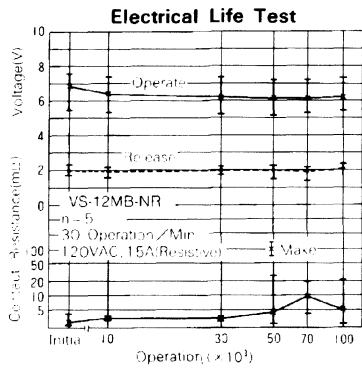
Electrical Life Test



Electrical Life Test



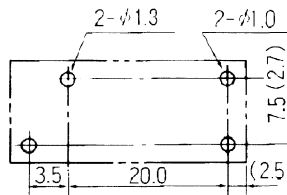
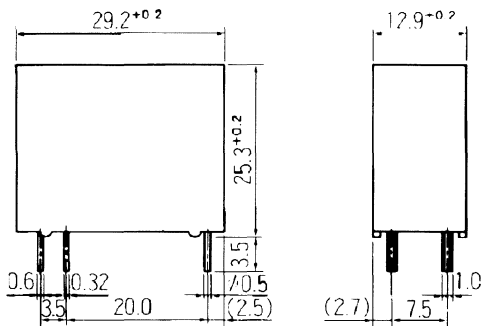
VS SERIES



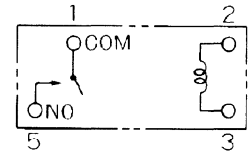
■ DIMENSIONS

● Dimensions

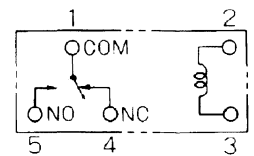
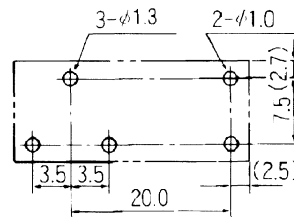
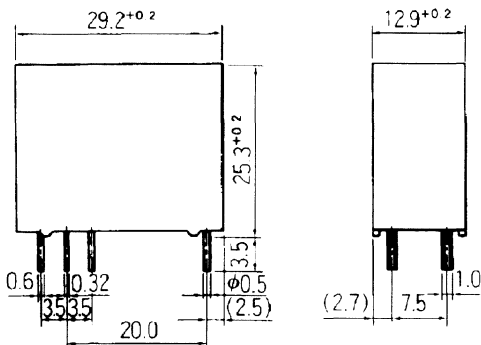
VS-M type



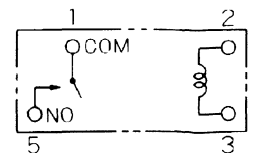
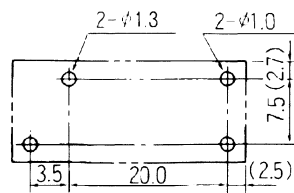
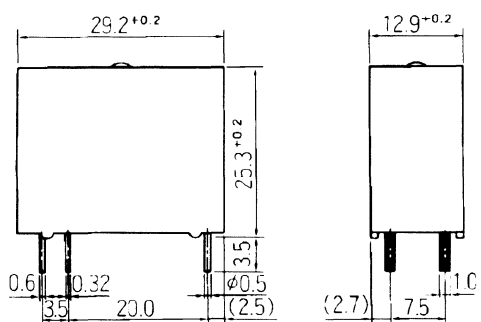
● PC board mounting hole layout (BOTTOM VIEW)



VS type



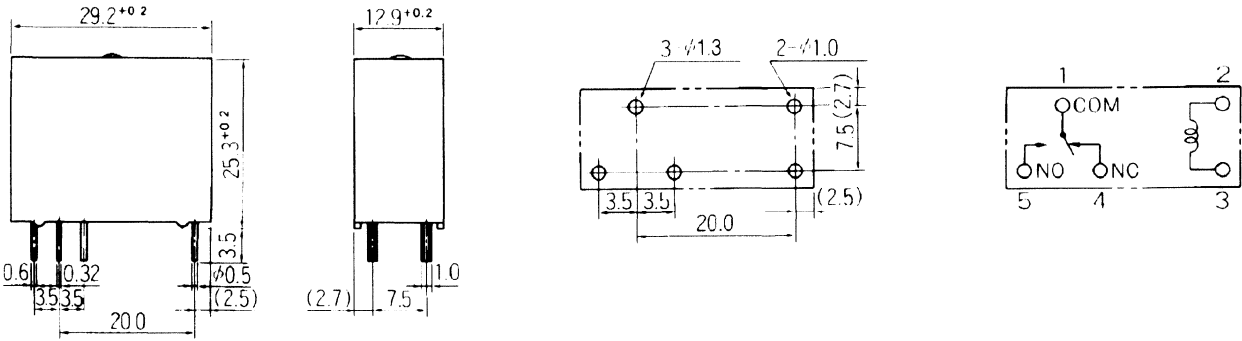
VS-MK type (Plastic sealed type)



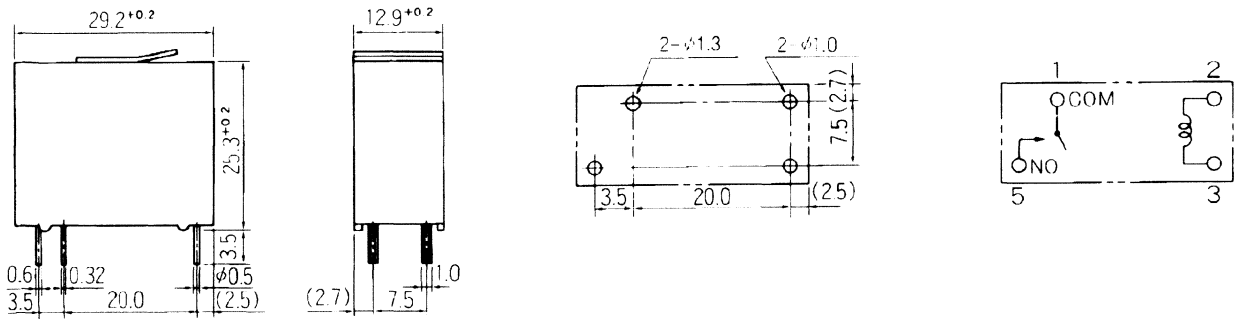
Unit: mm

VS SERIES

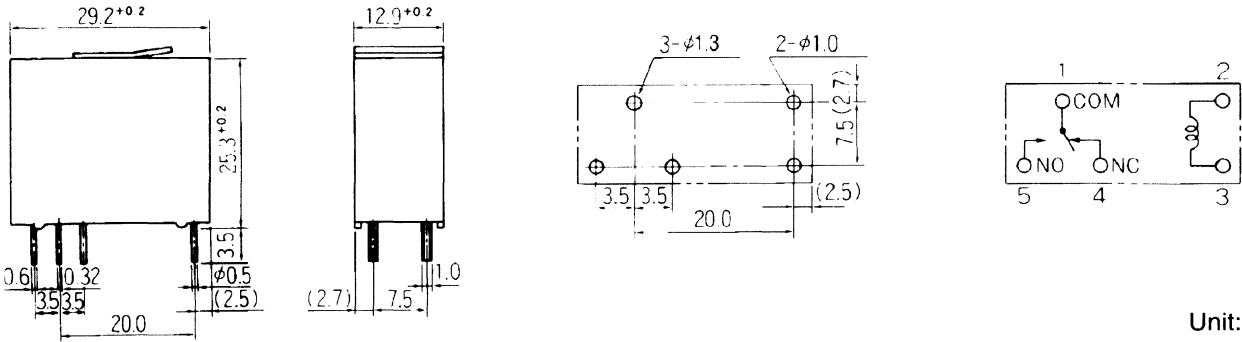
VS-K type (Plastic sealed type)



VS-MC type (Plastic sealed type with tape)



VS-C type (Plastic sealed type with tape)



Unit: mm

VS SERIES

NOTES

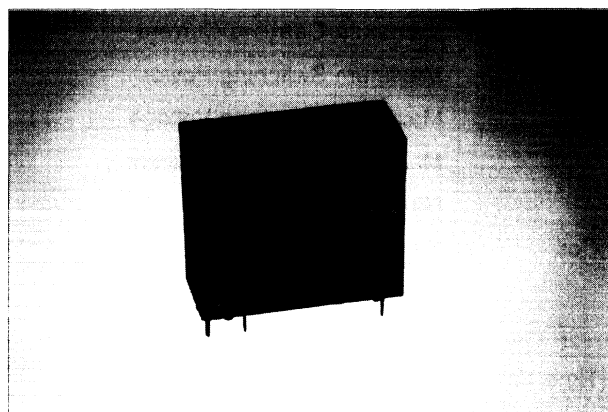


POWER RELAY

1 POLE—16 A (HEAVY POWER CONTROL) VSB SERIES

■ FEATURES

- All or nothing relay
- UL, CSA, VDE, SEV, SEMKO, IMQ, ÖVE, BSI recognized
- Working class: C
- Type of service: continuous duty
- Heavy duty 16 A miniature power relay
- UL Class B (130°C) insulation
 - Insulation distance: 8 mm
 - Dielectric strength: 5,000 VAC (between coil and contacts)
 - Surge strength: 10,000 V
- Low power consumption and high sensitivity type available (VSB-S)
- Plastic sealed (with tape) type available



■ ORDERING INFORMATION

[Example] VSB - 12 S T B
 (a) (*) (b) (c) (d) (e)

| | | |
|-----|---------------------|---|
| (a) | Series Name | VSB: VSB Series |
| (b) | Nominal Voltage | Refer to the COIL DATA CHART |
| (c) | Coil Type | Nil : Standard type S : High sensitivity type |
| (d) | Contact Arrangement | M : 1 form A (SPST-NO) T : 1 form C (SPDT) |
| (e) | Enclosure | B : Flux free type C : Plastic sealed type (with tape) |

Note: Actual marking omits the hyphen (-) of (*)

■ SAFETY STANDARD AND FILE NUMBERS

UL508, (File No. E56140, E108658)
C22.2 No. 14 (File No. LR35579)
VDE0435, 0631, 0700

| Nominal voltage | Contact rating |
|-----------------|---|
| 3 to 100 VDC | 1/3 HP 125 VAC/250 VAC 16 A 30 VDC/250 VAC resistive Pilot duty C 150 |


VSB SERIES

■ SPECIFICATIONS

| Item | | Standard Type | High Sensitive Type |
|------------------|------------------------------|---|--|
| | | VSB-() | VSB-()-S |
| Contact | Arrangement | 1 form A (SPST-NO) or 1 form C (SPDT) | |
| | Material | Silver alloy | |
| | Style | Single | |
| | Resistance (initial) | Maximum 200 mΩ (at 1 A 6 VDC) | |
| | Rating (resistive) | 16 A 250 VAC/30 VDC | |
| | Maximum Carrying Current | 16 A | |
| | Maximum Switching Power | 4,000 VA, 480 W | |
| | Maximum Switching Voltage | 380 VAC, 150 VDC | |
| | Maximum Switching Current | 16 A | |
| | Minimum Switching Load*1 | 100 mA 5 VDC | |
| Coil | Nominal Power (at 20°C) | 0.7 to 0.75 W | 0.53 W |
| | Nominal Voltage (at 20°C) | 0.35 to 0.37 W | 0.26 W |
| | Operating Temperature | -40°C to +65°C (no frost) | -40°C to +75°C (no frost) |
| Time Value | Operate (at nominal voltage) | Maximum 20 ms | |
| | Release (at nominal voltage) | Maximum 10 ms | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute |
| | | between coil and contacts*2 | 5,000 VAC 1 minute |
| Surge Strength*3 | 10,000 V (at 1.2 x 50 μs) | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | |
| | Electrical | 100 x 10 ³ operations minimum (contact rating) | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) |
| | | Endurance | 10 to 55 Hz (double amplitude of 1.5 mm) |
| | Resistance | Misoperation | 100 m/s ² (11 ±1 ms) |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) |
| | Weight | Approximately 18 g | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

*2 IMQ 

*3 IMQ 

VSB SERIES

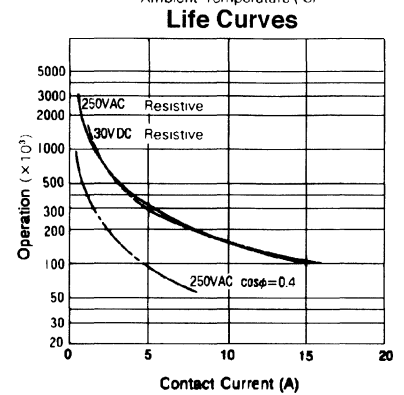
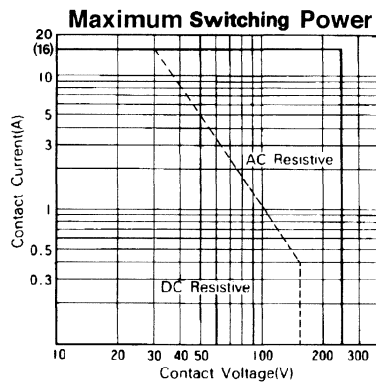
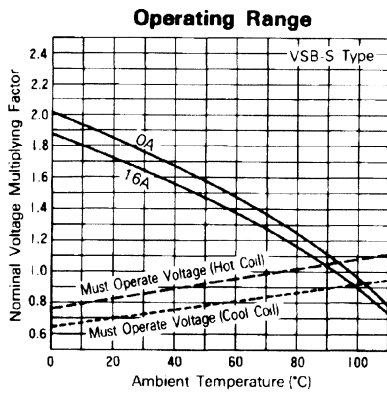
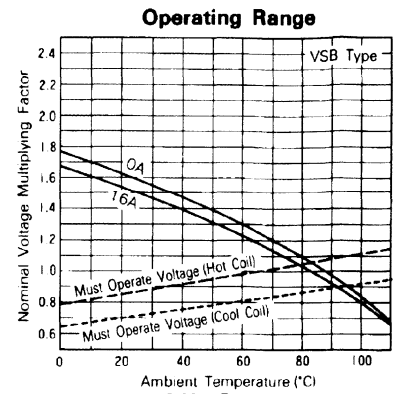
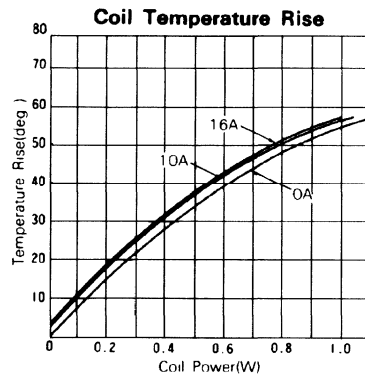
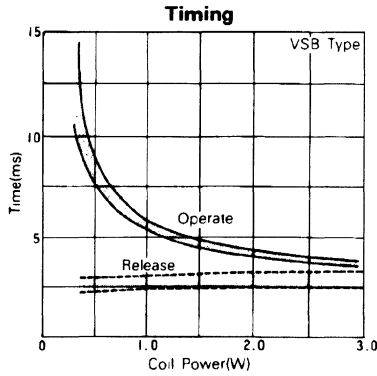
■ COIL DATA CHART

| | MODEL | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage | Nominal power |
|-----------------------|------------------|-----------------|------------------------|----------------------|----------------------|---------------|
| Standard Type | VSB- 3 () () | 3 VDC | 12.5 Ω | 2.1 VDC | 0.3 VDC | 0.72 W |
| | VSB- 5 () () | 5 VDC | 36 Ω | 3.5 VDC | 0.5 VDC | 0.70 W |
| | VSB- 6 () () | 6 VDC | 50 Ω | 4.2 VDC | 0.6 VDC | 0.72 W |
| | VSB- 9 () () | 9 VDC | 115 Ω | 6.3 VDC | 0.9 VDC | 0.70 W |
| | VSB- 12 () () | 12 VDC | 200 Ω | 8.4 VDC | 1.2 VDC | 0.72 W |
| | VSB- 14 () () | 14 VDC | 280 Ω | 9.8 VDC | 1.4 VDC | 0.70 W |
| | VSB- 18 () () | 18 VDC | 460 Ω | 12.6 VDC | 1.8 VDC | 0.70 W |
| | VSB- 24 () () | 24 VDC | 820 Ω | 16.8 VDC | 2.4 VDC | 0.70 W |
| | VSB- 36 () () | 36 VDC | 1,850 Ω | 25.2 VDC | 3.6 VDC | 0.70 W |
| | VSB- 48 () () | 48 VDC | 3,300 Ω | 33.6 VDC | 4.8 VDC | 0.70 W |
| | VSB- 60 () () | 60 VDC | 5,100 Ω | 42.0 VDC | 6.0 VDC | 0.70 W |
| VSB-100 () () | 100 VDC | 13,400 Ω | 70.0 VDC | 10.0 VDC | 0.75 W | |
| High Sensitivity Type | VSB- 3S () () | 3 VDC | 17 Ω | 2.1 VDC | 0.3 VDC | 0.53 W |
| | VSB- 5S () () | 5 VDC | 47 Ω | 3.5 VDC | 0.5 VDC | 0.53 W |
| | VSB- 6S () () | 6 VDC | 68 Ω | 4.2 VDC | 0.6 VDC | 0.53 W |
| | VSB- 9S () () | 9 VDC | 155 Ω | 6.3 VDC | 0.9 VDC | 0.53 W |
| | VSB- 12S () () | 12 VDC | 270 Ω | 8.4 VDC | 1.2 VDC | 0.53 W |
| | VSB- 14S () () | 14 VDC | 370 Ω | 9.8 VDC | 1.4 VDC | 0.53 W |
| | VSB- 18S () () | 18 VDC | 610 Ω | 12.6 VDC | 1.8 VDC | 0.53 W |
| | VSB- 24S () () | 24 VDC | 1,100 Ω | 16.8 VDC | 2.4 VDC | 0.53 W |
| | VSB- 36S () () | 36 VDC | 2,450 Ω | 25.2 VDC | 3.6 VDC | 0.53 W |
| | VSB- 48S () () | 48 VDC | 4,400 Ω | 33.6 VDC | 4.8 VDC | 0.53 W |
| | VSB- 60S () () | 60 VDC | 6,800 Ω | 42.0 VDC | 6.0 VDC | 0.53 W |
| VSB-100S () () | 100 VDC | 18,560 Ω | 70.0 VDC | 10.0 VDC | 0.53 W | |

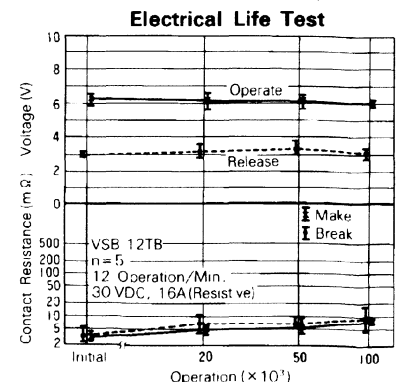
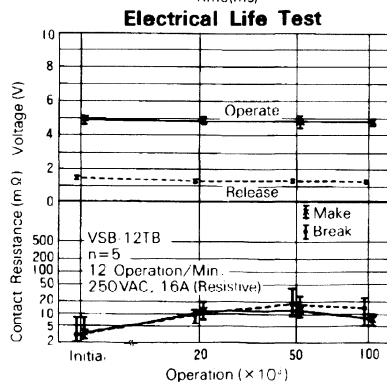
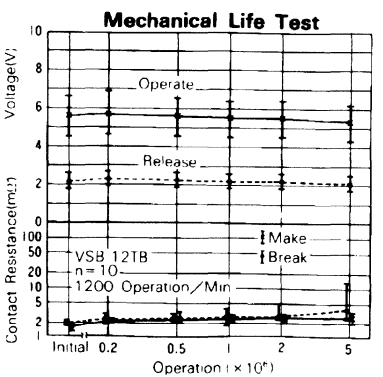
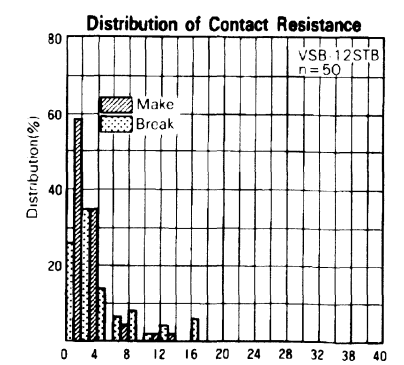
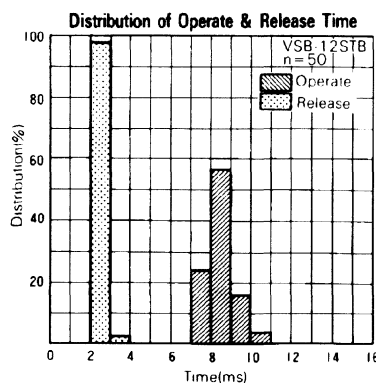
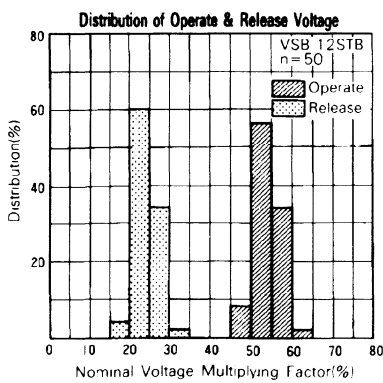
Note: All values in the table are measured at 20°C

VSB SERIES

CHARACTERISTIC DATA



REFERENCE DATA

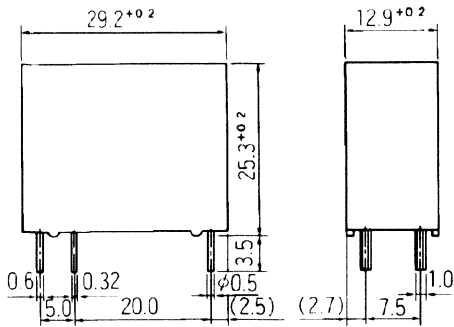


VSB SERIES

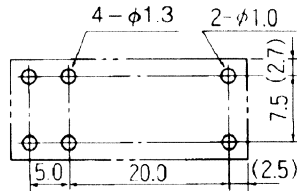
■ DIMENSIONS

● Dimensions

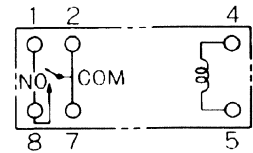
VSB-M type



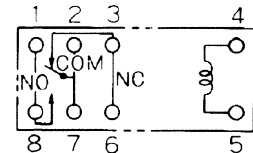
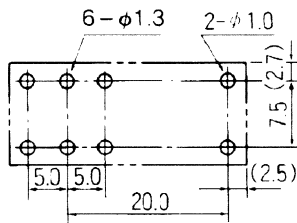
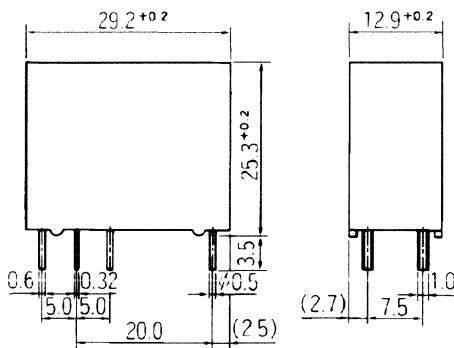
● Schematics (BOTTOM VIEW)



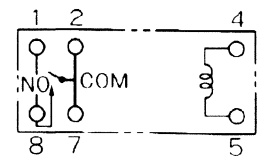
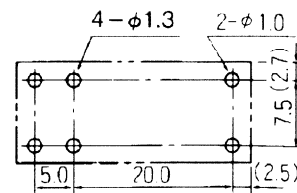
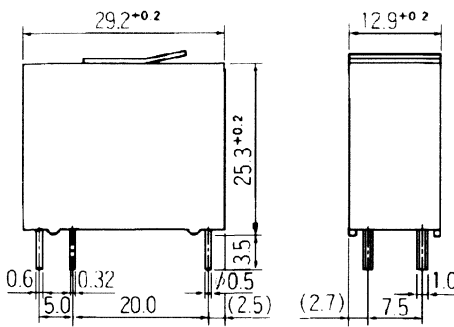
● PC board mounting hole layout (BOTTOM VIEW)



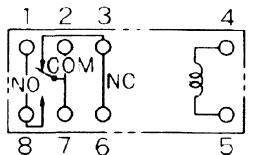
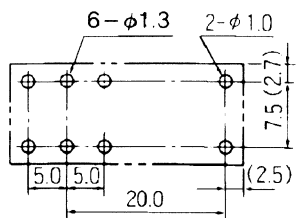
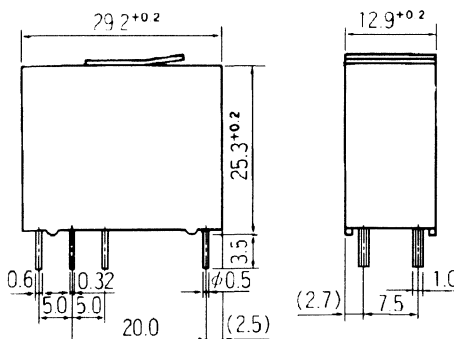
VSB type



VSB-MC type (Plastic sealed type with tape)



VSB-C type (Plastic sealed type with tape)



Unit: mm

VSB SERIES

NOTES

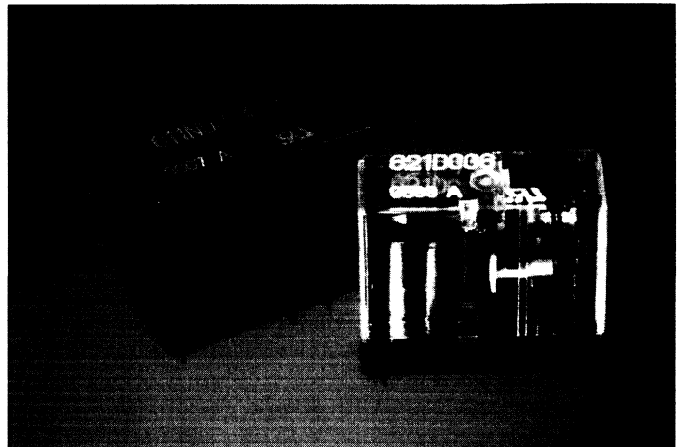


POWER RELAY

1, 2 POLES—5, 10, 16 A FBR610, 620 SERIES

■ FEATURES

- Maximum switching capacity of 30 VDC, 16 A and 240 VAC, 16 A (single pole, K type)
- 5 kV AC minimum dielectric strength (between coil and contacts)
- 10 kV minimum surge strength (between coil and contacts)
- Coil terminal separated from output terminals to allow easy PC board design
- High reliability design conforming to safety standards Japan Electrical Appliance Control Law (150–300 V)
- UL 508



■ ORDERING INFORMATION

[Example] FBR6 1 3 N D012 -K -CSA
 (a) (b) (c) (d) (e) (f) (g)

| | | |
|-----|---------------------|--|
| (a) | Series Name | FBR6: FBR600 Series |
| (b) | Number of Contacts | 1 : 1 pole 2 : 2 poles |
| (c) | Contact Arrangement | 1 : Form C 3 : Form A 5 : Form B |
| (d) | Enclosure | Nil : Flux free type N : Plastic sealed type |
| (e) | Nominal Voltage | (Example) 012: 12 VDC 024: 24 VDC (refer to the COIL DATA CHART) |
| (f) | Contact Rating | Nil : Standard -K : K type (1 pole ONLY) |
| (g) | Safety Standards | Nil : UL 508 recognized -CSA: UL 508 + CSA recognized -T : VDE + UL 508 + CSA recognized Only for 1 form C and 1 form A standard types. (refer to the SAFETY AND FILE NUMBERS) |

Note: The designation name is stamped on the top of the relay case as follows:

(Example) Designation ordered: FBR611ND024

Stamp: 611ND024

FBR610, 620 SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL508, (File No. E63614)

C22.2 No. 0, No. 14 (File No. LR40304 or LR64026)

VDE0435, 0860 (File No. 5304UG)

| Type | | Safety Standard | | | Nominal voltage | | Contact ratings | |
|---------|----------|--------------------|------------|------------|-----------------|--|-----------------|---|
| | | UL | CSA | VDE | | | | |
| 1 Pole | Standard | 1 form C, 1 form A | recognized | recognized | 5 to 60 VDC | | UL | 10 A 240 VAC resistive |
| | | 1 form B | | | | | — | CSA |
| | K type | 1 form C | recognized | recognized | | | UL | 10 A 240 VAC resistive |
| | | 1 form A, 1 form B | | | | | — | CSA |
| 2 Poles | standard | | recognized | recognized | | | UL | 10 A 240 VAC resistive 10 A 30 VDC resistive |
| | | | | | | | CSA | 6 A 240 VAC resistive 6 A 30 VDC resistive |

FBR610, 620 SERIES

■ SPECIFICATIONS

| Item | | 1 Pole type | | | | 2 Poles type |
|---------------------------|---|---|--|-----------------------------|---------------------------|--------------|
| | | Standard | K type | | | |
| | | | 1 form A, B | 1 form C | | |
| Contact | Arrangement | 1 form C, A, B | 1 form A, B | 1 form C | 2 form C, A, B | |
| | Material | Silver-cadmium oxide | | | | |
| | Resistance (initial) | Maximum 100 mΩ (at 1 A 6 VDC) | | | | |
| | Ratings (resistive load) | 10 A 240 VAC 10 A 30 VDC | 16 A 240 VAC 16 A 30 VDC | 10 A 240 VAC 10 A 30 VDC | 5 A 240 VAC 5 A 30 VDC | |
| | Maximum Carrying Current | 14 A | 16 A | | 7 A | |
| | Maximum Switching Power | 2,400VA or 300W | 3,840VA or 480W | 2,400 VA or 300W | 1,200 VA or 150 W | |
| | Max. Switching Voltage* ¹ | 250 VAC or 125 VDC | | | | |
| | Minimum Switching Load* ² | 0.5 W (5 V, 100 mA) | | | | |
| Coil | Power Consumption | Rated | Approximately 0.5 W (at 20°C) | | | |
| | | Operate | Approximately 0.35 W (at 20°C) | | | |
| | Operating Temperature | -40°C to +70°C (no frost) (refer to the CHARACTERISTIC DATA) * ³ | | | | |
| Time Value | Operating Humidity | 45 to 85%RH | | | | |
| | Operate (at nominal voltage) | Maximum 15 ms | | | | |
| Insulation | Release (at nominal voltage) | Maximum 5 ms | | | | |
| | Resistance (initial) | Minimum 100 MΩ (at 500 VDC) | | | | |
| | Dielectric Strength | Between open contacts | 1,000 VAC 1 minute | | | |
| | | Between coil and contacts | 5,000 VAC 1 minute | | | |
| Between adjacent contacts | — | 3,000 VAC 1 minute | | | | |
| Life | Surge Strength | 10,000 V (at 1.2 x 50 μs) | | | | |
| | Mechanical | 20 x 10 ⁶ operations minimum | | | | |
| | Electical (refer to the REFERENCE DATA) | DC | 100 x 10 ³ operations minimum (at contact rating) | | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) | | | |
| | | Endurance | 10 to 55 Hz (double amplitude of 1.5 mm) | | | |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ± ¹ ms) | | | |
| | | Endurance | 500 m/s ² (11 ± ¹ ms) | | | |
| | Weight | Approximately 16 g | | | | |

*¹ If the switching voltage exceeds the rated contact voltage.

*² Values when switching a resistive load at normal room temperature and humidity, and in a clean environment. The minimum switching load varies with the switching frequency and operation environment.

*³ Based on UL Class A coil insulation system.

FBR610, 620 SERIES

■ COIL DATA CHART

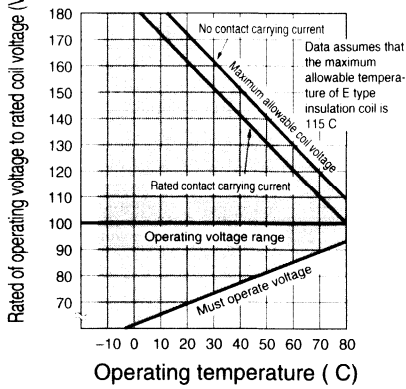
| MODEL | | | Nominal voltage | Coil resistance ($\pm 10\%$) | Nominal current (at nominal voltage) approx. | Must operate voltage | Must release voltage | Maximum allowable voltage | Nominal power | Coil temperature rise |
|--|--------------|--|-----------------|--------------------------------|--|-----------------------------|-----------------------------|-----------------------------|-------------------------------------|-------------------------------------|
| 1 Pole type | | 2 Poles type | | | | | | | | |
| Standard | K type | Standard | | | | | | | | |
| FBR611, 611N FBR613, 613N FBR615, 615N | | FBR621, 621N FBR623, 623N FBR625, 625N | | | | | | | | |
| FBR61 D005 | FBR61 D005-K | FBR62 D005 | 5 VDC | 50 Ω | 100 mA | 70% max. of nominal voltage | 10% min. of nominal voltage | Refer to the REFERENCE DATA | Approx. 500 mW (at nominal voltage) | Approx. 35 deg (at nominal voltage) |
| FBR61 D006 | FBR61 D006-K | FBR62 D006 | 6 VDC | 72 Ω | 83 mA | | | | | |
| FBR61 D009 | FBR61 D009-K | FBR62 D009 | 9 VDC | 160 Ω | 56 mA | | | | | |
| FBR61 D012 | FBR61 D012-K | FBR62 D012 | 12 VDC | 285 Ω | 42 mA | | | | | |
| FBR61 D018 | FBR61 D018-K | FBR62 D018 | 18 VDC | 640 Ω | 28 mA | | | | | |
| FBR61 D024 | FBR61 D024-K | FBR62 D024 | 24 VDC | 1,150 Ω | 21 mA | | | | | |
| FBR61 D048 | FBR61 D048-K | FBR62 D048 | 48 VDC | 4,600 Ω | 10 mA | | | | | |
| FBR61 D060 | FBR61 D060-K | FBR62 D060 | 60 VDC | 7,200 Ω | 8 mA | | | | | |

Note: All values in the table are measured at 20°C.

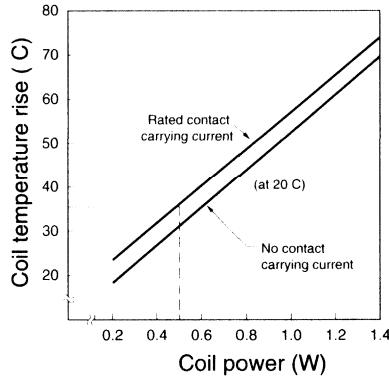
FBR610, 620 SERIES

CHARACTERISTIC DATA

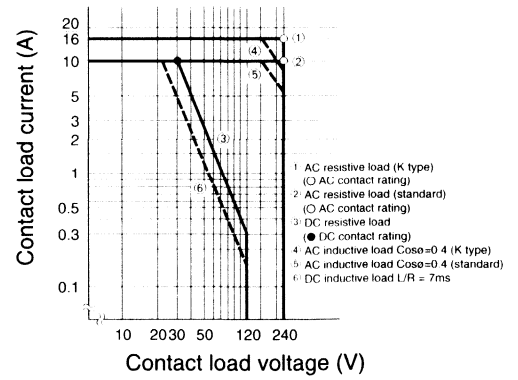
Range of operation temperature and voltage



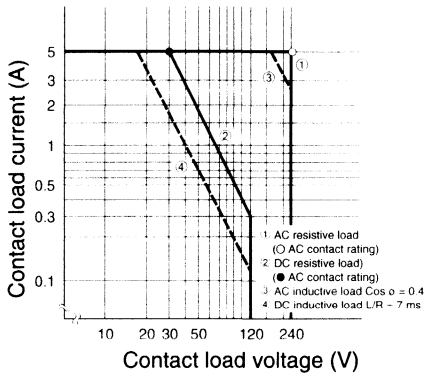
Coil temperature rise data



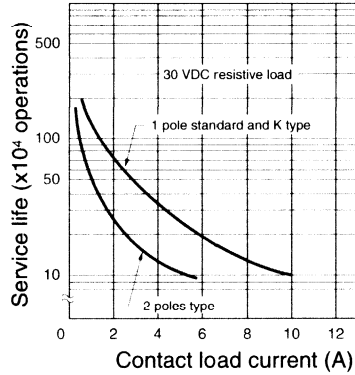
Maximum switching capacity (1 pole type)



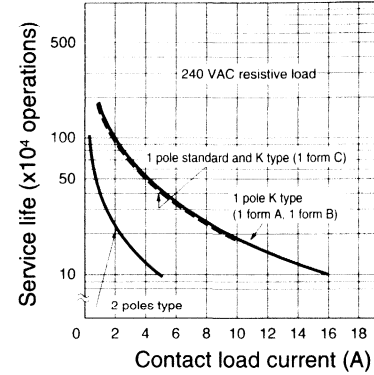
Maximum switching capacity (2 poles type)



Life curves (DC load)

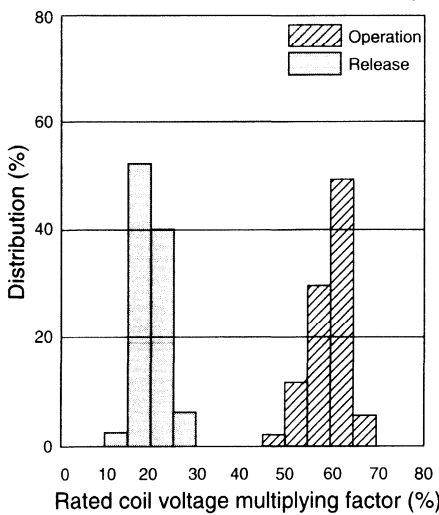


Life curves (AC load)

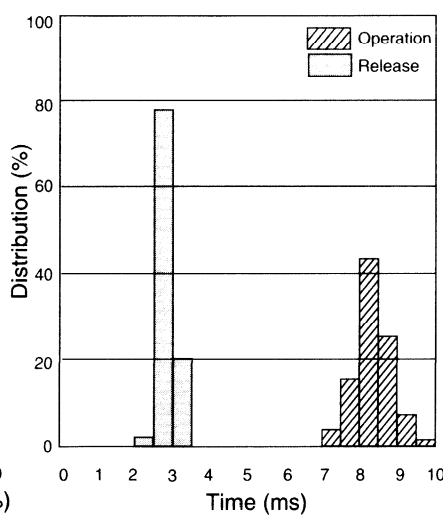


REFERENCE DATA

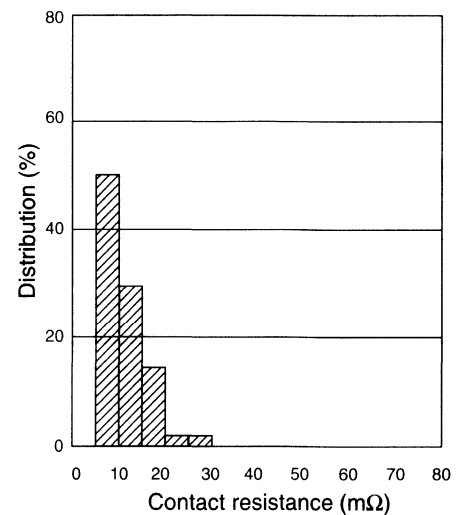
Distribution of operate and release voltage



Distribution of operate and release time



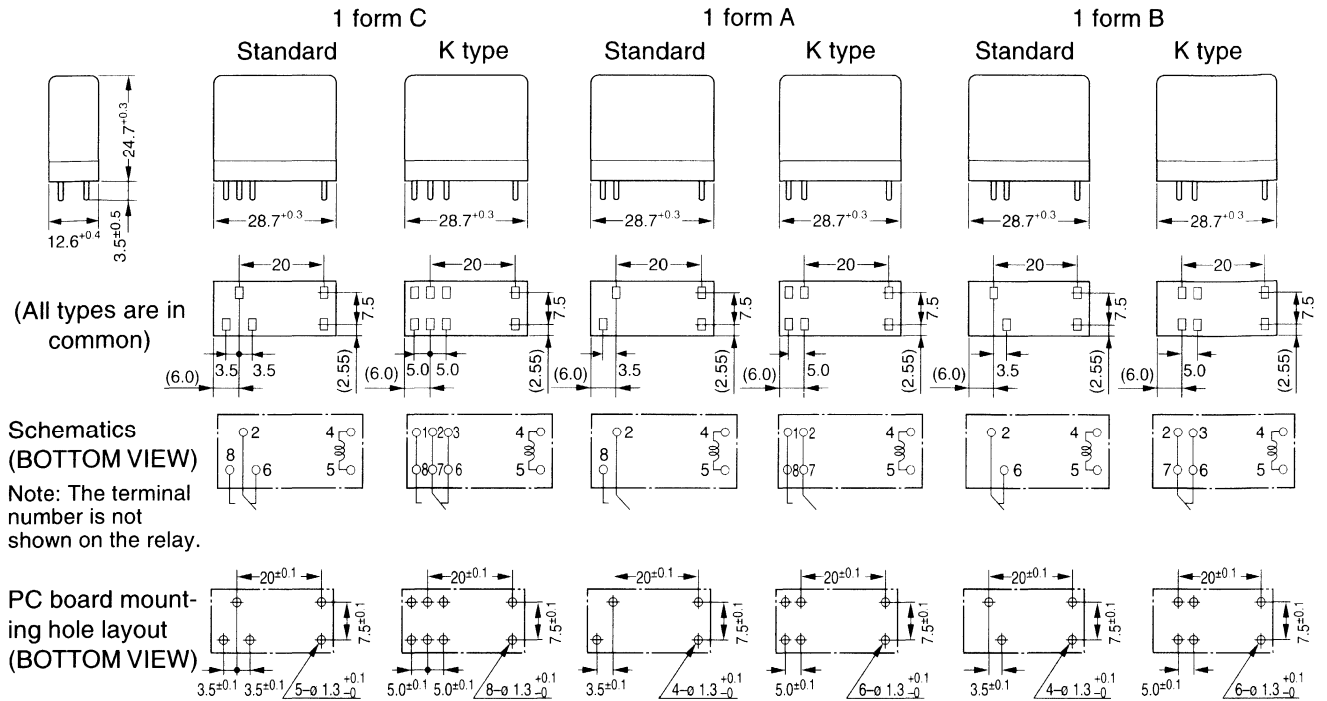
Distribution of contact resistance



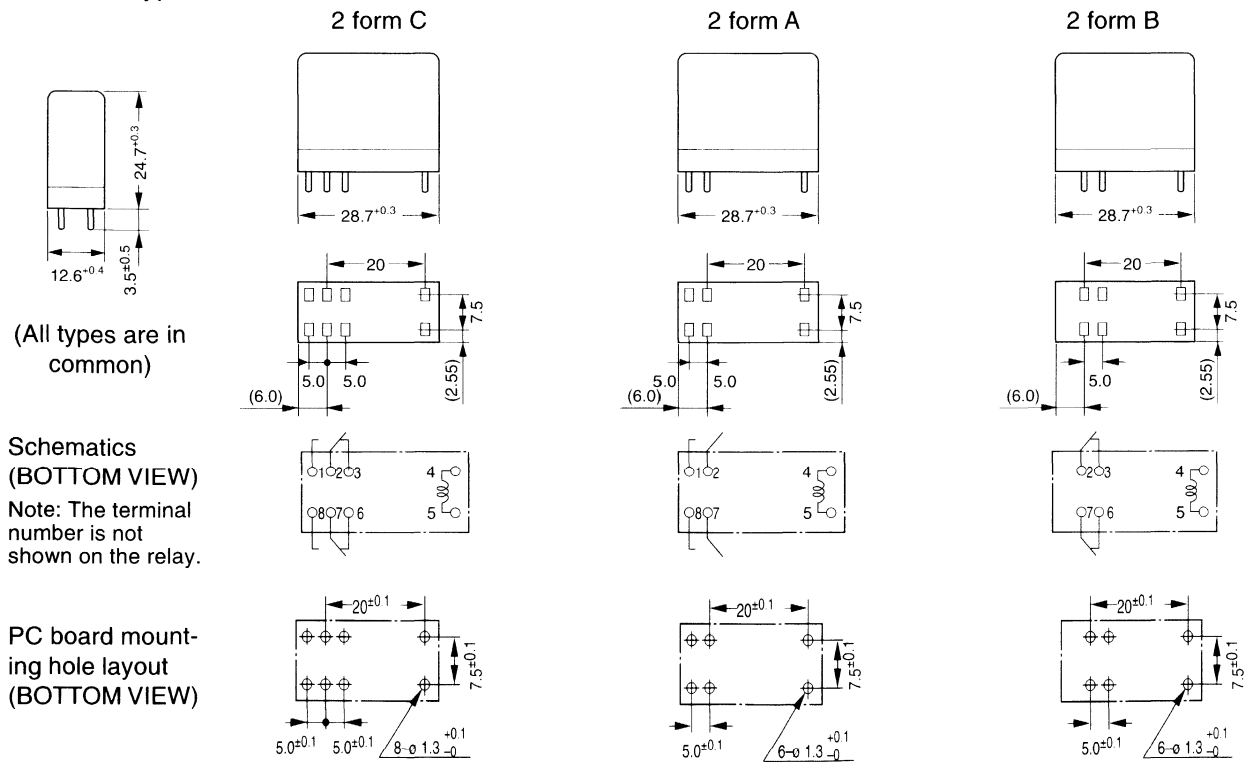
FBR610, 620 SERIES

■ DIMENSIONS

1. 1 Pole type



2. 2 Poles type



Unit: mm

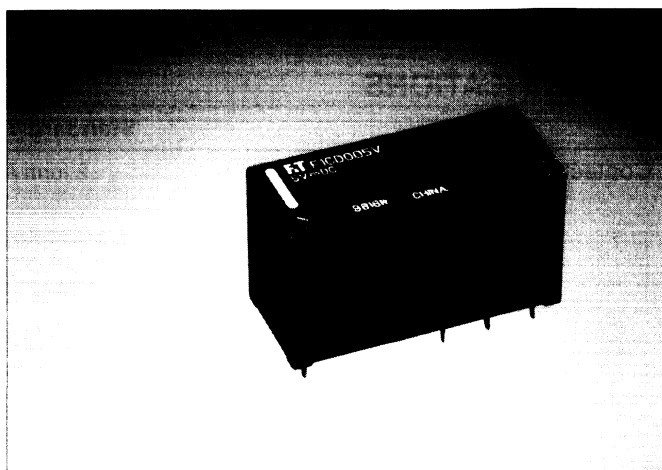
POWER RELAY

2 POLES—5 A LOW PROFILE TYPE

FTR-F1 SERIES

■ FEATURES

- Low profile power relay (height 16.5 mm) employing unique construction
DPST/DPDT 5 A, TV-3 rating available
- Higher isolation by employing reinforced insulation construction
Insulation distance: 8 mm (between coil and contact)
Dielectric strength: 5 kV (between coil and contact)
Surge strength: 10 kV (between coil and contact)
- Plastic sealed relay backfilled with nitrogen
- Pin configuration compatible to VB/FBR620
- UL, CSA, VDE, SEMKO, BSI recognized
- Conforms to FIMKO, IMQ, DEMKO (under approval)
- Environmentally friendly cadmium free contact type is available



■ ORDERING INFORMATION

[Example] FTR-F1 A A 005 V - **
 (a) (b) (c) (d) (e) (f)

| | | |
|-----|--------------------------|--|
| (a) | Series Name | FTR-F1: FTR-F1 Series |
| (b) | Contact Arrangement | A : 2 form A (DPST-NO) C : 2 form C (DPDT) |
| (c) | Coil Type | A : Standard type (0.53 W) D : High sensitive type (0.4W) |
| (d) | Nominal Voltage | 005 : 5 VDC 012: 12 VDC 006 : 6 VDC 024: 24 VDC 009 : 9 VDC 048: 48 VDC |
| (e) | Contact Material/TV Type | V : Gold plate silver alloy (standard type) T : Gold plate silver alloy (TV-3 rating type, only standard make type) |
| (f) | Custom Designation | To be assigned custom specification |

Ordering Code: Actual Marking:
FTR-F1AA005V F1AA005V

FTR-F1 SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E63614)

C22.2 No. 14 (File No. LR40304-30)

VDE 0435, 0631, 0700, 0860

| | Type | Nominal voltage | Contact rating |
|------------------------|--------------|-----------------|---|
| TV-Rating | FTR-F1AA()T | 5 ~ 48 VDC | TV-5 120 VAC 1/6 HP 125 VAC 1/4 HP 250 VAC 5 A 24 VDC/250 VAC resistive Pilot duty B 300 |
| Standard/ sensitive | FTR-F1DA()V | 5 ~ 48 VDC | Same as above without TV-5 2A 250VAC inductive (PF=0.4) |

■ SPECIFICATIONS

| Item | | Standard Type | Sensitive Type | TV-3 Rating Type |
|----------------|------------------------------|--|--|--------------------------------------|
| Contact | Arrangement | 2 form A (DPST-NO), 2 form C (DPDT) | | 2 form A (DPST-NO) |
| | Material | Gold plate silver alloy | | |
| | Style | Single | | |
| | Resistance (initial) | Maximum 100 mΩ (at 1 A 6 VDC) | | |
| | Rating (resistive) | 5 A 250 VAC/24 VDC | | |
| | Maximum Carrying Current | 7 A | | |
| | Maximum Switching Rating | 1,250 VA/120 W | | |
| | Maximum Switching Voltage | 400 VAC 300 VDC | | |
| | Maximum Switching Current | 5 A | | |
| | Minimum Switching Load*1 | 10 mA 5 VDC | | |
| | Maximum Inrush Current | — | | 51 A 120 VAC (at lamp load) |
| Coil | Nominal Power (at 20°C) | 0.53 W | 0.4 W | 0.53 W |
| | Operate Power (at 20°C) | 0.26 W | 0.225W | 0.26W |
| | Operating Temperature | -40°C to +75°C (no frost) (refer to the CHARACTERISTIC DATA) | | |
| Time Value | Operate (at nominal voltage) | Maximum 15 ms | | |
| | Release (at nominal voltage) | Maximum 5 ms | | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute (3,000 VAC between adjacent contacts) | |
| | | between coil and contacts | 5,000 VAC 1 minute | |
| Surge Strength | 10,000 V (at 1.2 x 50 μs) | | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | |
| | Electrical | Contact Rating | 100 x 10 ³ operations minimum | |
| | | Lamp Load | — | 25 x 10 ³ operations min. |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.65 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 3.3 mm) | |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ±1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| | Weight | Approximately 12 g | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

FTR-F1 SERIES

■ COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage |
|----------------------|------------------|-----------------|------------------------|----------------------|----------------------|
| Standard Type | TV-3 Rating Type | | | | |
| FTR-F1 (C, A) A005 V | FTR-F1AA005 T | 5 VDC | 47 Ω | 3.5 VDC | 0.5 VDC |
| FTR-F1 (C, A) A006 V | FTR-F1AA006 T | 6 VDC | 68 Ω | 4.2 VDC | 0.6 VDC |
| FTR-F1 (C, A) A009 V | FTR-F1AA009 T | 9 VDC | 155 Ω | 6.3 VDC | 0.9 VDC |
| FTR-F1 (C, A) A012 V | FTR-F1AA012 T | 12 VDC | 270 Ω | 8.4 VDC | 1.2 VDC |
| FTR-F1 (C, A) A024 V | FTR-F1AA024 T | 24 VDC | 1,100 Ω | 16.8 VDC | 2.4 VDC |
| FTR-F1 (C, A) A048 V | FTR-F1AA048 T | 48 VDC | 4,400 Ω | 33.6 VDC | 4.8 VDC |
| FTR-F1 (C, A) A060 V | - | 60 VDC | 68,000 Ω | 45.5 VDC | 6.0 VDC |
| FTR-F1 (C, A) A110 V | - | 110 VDC | 22,000 Ω | 82.5 VDC | 11.0 VDC |

Note: All values in the table are measured at 20°C.

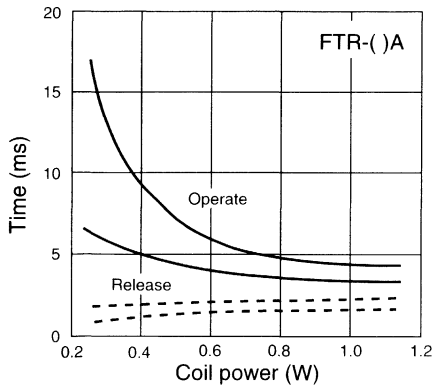
Sensitive Type

| MODEL | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage |
|----------------------|--|-----------------|------------------------|----------------------|----------------------|
| Standard Type | | | | | |
| FTR-F1 (C, A) D005 V | | 5 VDC | 62 Ω | 3.75 VDC | 0.5 VDC |
| FTR-F1 (C, A) D006 V | | 6 VDC | 90 Ω | 4.5 VDC | 0.6 VDC |
| FTR-F1 (C, A) D009 V | | 9 VDC | 202 Ω | 6.75 VDC | 0.9 VDC |
| FTR-F1 (C, A) D012 V | | 12 VDC | 360 Ω | 9.0 VDC | 1.2 VDC |
| FTR-F1 (C, A) D024 V | | 24 VDC | 1,440 Ω | 18.0 VDC | 2.4 VDC |
| FTR-F1 (C, A) D048 V | | 48 VDC | 5,760 Ω | 36.0 VDC | 4.8 VDC |

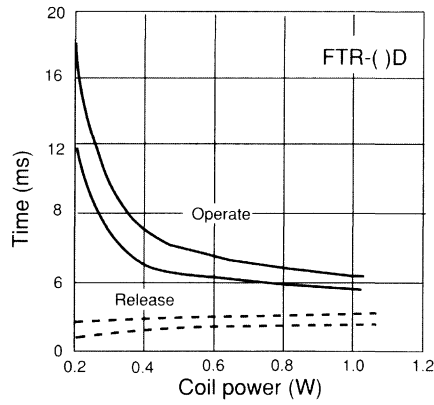
FTR-F1 SERIES

CHARACTERISTIC DATA

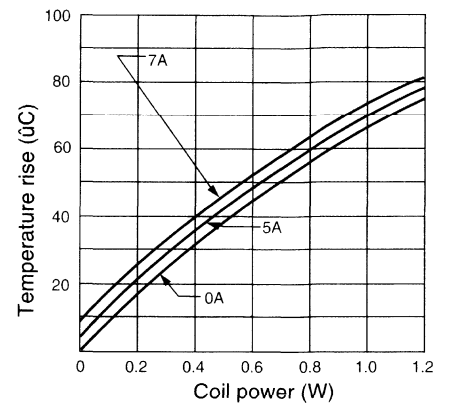
Timing



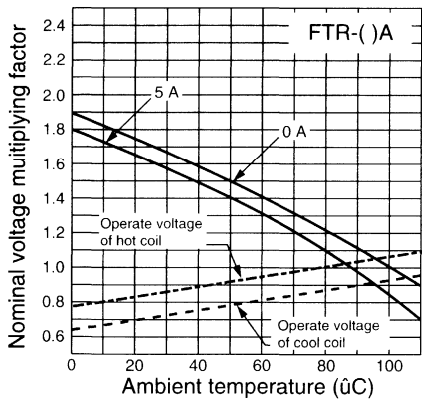
Timing



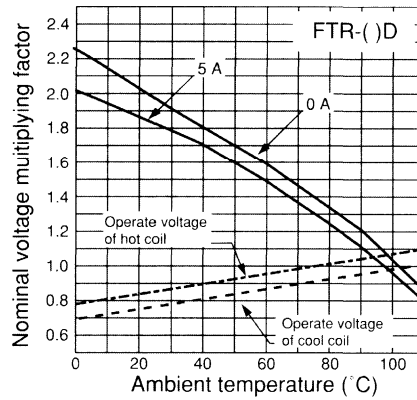
Coil temperature rise



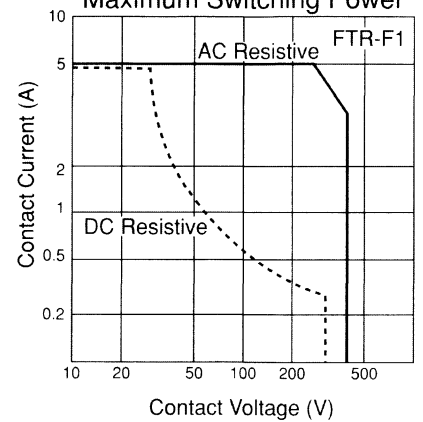
Operating range



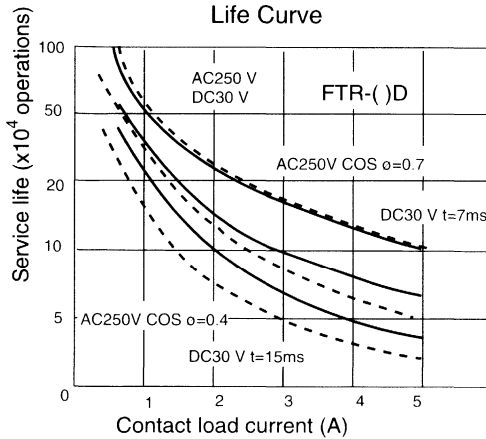
Operating range



Maximum Switching Power



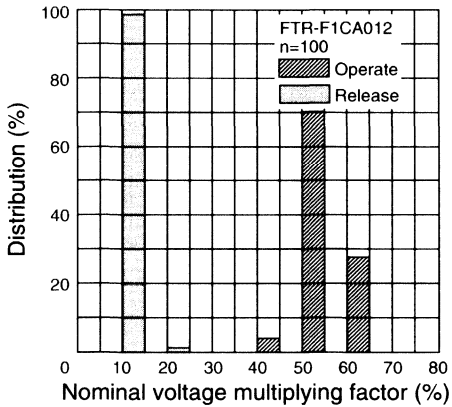
Life Curve



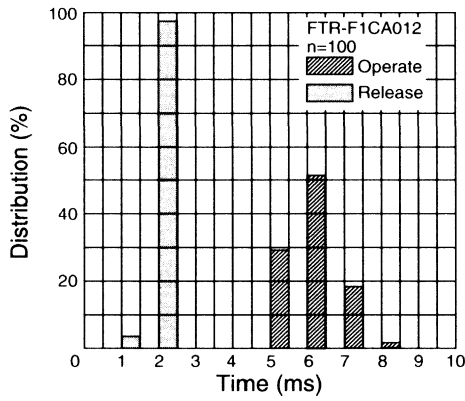
FTR-F1 SERIES

REFERENCE DATA

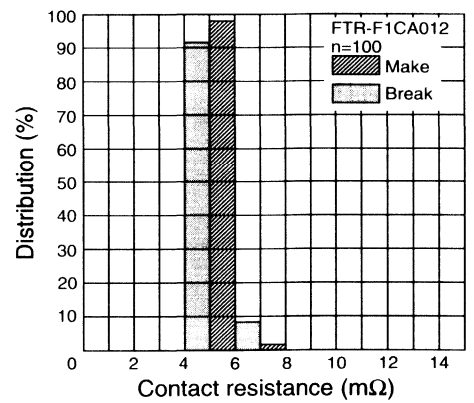
Distribution of operate and release voltage



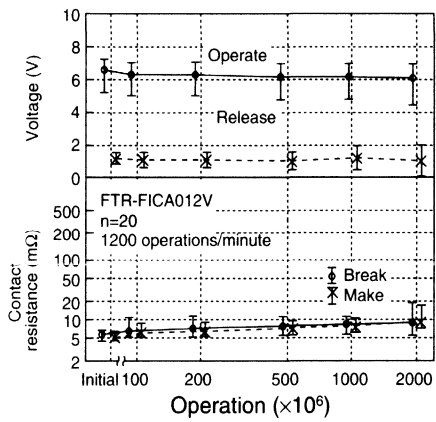
Distribution of operate and release time



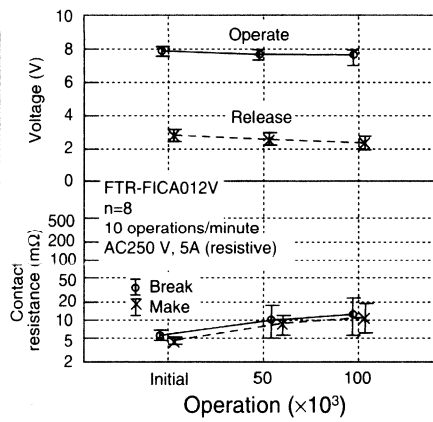
Distribution of contact resistance



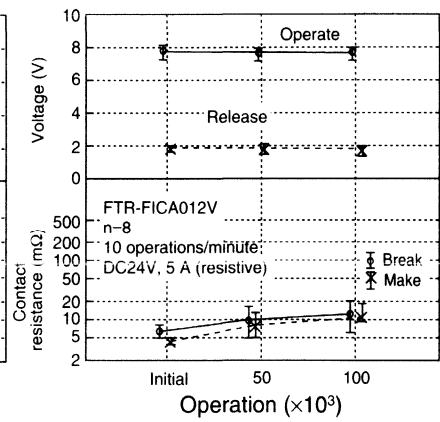
Mechanical life test



Electrical life test



Electrical life test

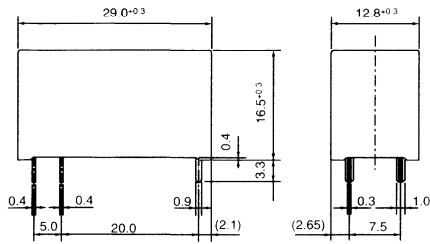


FTR-F1 SERIES

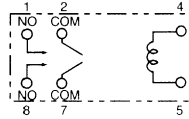
■ DIMENSIONS

● Dimensions

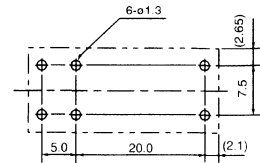
FTR-F1A type



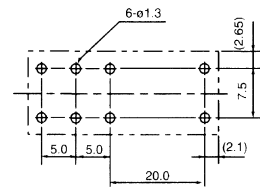
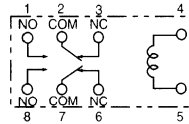
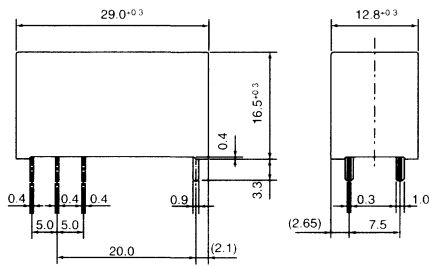
● Schematics (BOTTOM VIEW)



● PC board mounting hole layout (BOTTOM VIEW)



FTR-F1C type



Unit: mm

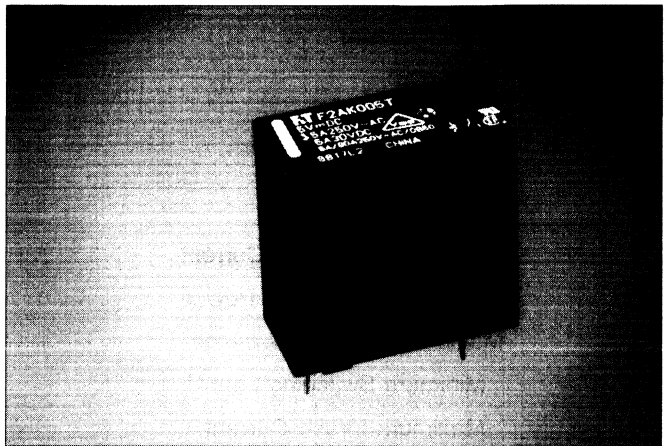
POWER RELAY

1 POLE 5A/TV-5 RATED COMPACT TYPE

FTR-F2 SERIES

■ FEATURES

- HIGH DENSITY MOUNTING
Saves space by 26% compared to FTR-H1 type
- HIGH ISOLATION
Insulation distance: minimum 6mm between coil and contact
Dielectric strength: 4 kV
Surge strength: 10 kV
- HIGH NOISE RESISTANCE
Uses card separation for high noise resistance between coil and contacts
- HEAT RESISTANCE, FLAMMABILITY 94V-0
- CADMIUM FREE CONTACT FOR ECO-PROGRAM
- SAFTY STANDARDS
UL, CSA, VDE approved (SEMKO pending)
UL, CSA TV-5 rating approved



■ ORDERING INFORMATION

[Example] $\frac{\text{FTR-F2}}{\text{(a)}} \quad \frac{\text{A}}{\text{(b)}} \quad \frac{\text{K}}{\text{(c)}} \quad \frac{\text{012}}{\text{(d)}} \quad \frac{\text{T}}{\text{(e)}} \quad \frac{\text{-**}}{\text{(f)}}$

| | | | | |
|-----|---------------------|--|---------------------------|-------------|
| (a) | Series Name | FTR-F2: FTR-F2 Series | | |
| (b) | Contact Arrangement | A | : 1 form A | |
| (c) | Coil Type | K | : Standard type (530 mW) | |
| | | L | : Sensitive type (250 mW) | |
| (d) | Nominal Voltage | 005 | : 5 VDC, 006 : 6VDC, | 009 : 9VDC |
| | | 012 | : 12VDC, 024 : 24VDC, | 048 : 48VDC |
| (e) | TV-Rating | T | : TV-5 | |
| (f) | Custom Designation | Special number for customized products | | |

Ordering Code: Actual Marking:
FTR-F2AK012T F2AK012T

FTR-F2 SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E63614)

C22.2 No. 14 (File No. LR40304-30)

VDE 0435, 0860

| | Nominal voltage | Contact rating |
|------------------------------|-----------------|--|
| TV-Rating Standard/sensitive | 5 ~ 48 VDC | TV-5 125 VAC 1/2 HP 250 VAC 1/6 HP 125 VAC 5 A 250 VAC/ 30 VDC resistive 2 A 250 VAC inductive (PF=0.4) Pilot duty C 300 |

■ SPECIFICATIONS

| Item | | FTR-F2 | |
|----------------|---|--|--|
| | | Standard Type | Sensitive Type |
| Contact | Arrangement | 1 form A (SPST-NO) | |
| | Material | Silver alloy | |
| | Style | Single | |
| | Resistance (initial) | Maximum 100 mΩ (at 1 A 6 VDC) | |
| | Rating (resistive) | 5A, 250 VAC/30 VDC | |
| | Maximum Carrying Current | 5 A | |
| | Maximum Switching Power | 1250 VA/150 W | |
| | Maximum Switching Voltage | 400 VAC/300 VDC | |
| | Minimum Switching Load*1 | 10 mA 5 VDC | |
| | Maximum Inrush Current | 120 VAC, 78A (TV-5) | |
| Coil | Nominal Power(at 20°C) | 530mW | 250mW |
| | Operate Power (at 20°C) | 260mW | 160mW |
| | Operating Temperature | -40°C to +70°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 15 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute |
| | | between coil and contacts | 4,000 VAC 1 minute |
| Surge Strength | 10,000 V (at 1.2 x 50 μs)(between coil and contact) | | |
| Life | Mechanical | 2 x 10 ⁶ operations minimum | |
| | Electrical | Contact rating | 100 x 10 ³ operations minimum |
| | | Lamp load | 25 x 10 ³ operations minimum |
| Vibration | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | Endurance | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| Shock | Misoperation | 200 m/s ² (11 ±1 ms) | |
| | Endurance | 1,000 m/s ² (6 ±1 ms) | |
| Weight | | Approximately 12 g | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

FTR-F2 SERIES

■ COIL DATA CHART

Standard type

| MODEL | Nominal voltage | Coil resistance | Operate voltage | Release voltage | Nominal power |
|--------------|-----------------|-----------------|-----------------|-----------------|---------------|
| FTR-F2AK005T | 5VDC | 47 Ω | 3.5 V | 0.25 V | 530mW |
| FTR-F2AK006T | 6VDC | 68 Ω | 4.2 V | 0.3V | 530mW |
| FTR-F2AK009T | 9VDC | 155 Ω | 6.3 V | 0.45V | 530mW |
| FTR-F2AK012T | 12VDC | 270 Ω | 8.4 V | 0.6V | 530mW |
| FTR-F2AK024T | 24VDC | 1,100 Ω | 16.8 V | 1.2V | 530mW |
| FTR-F2AK048T | 48VDC | 4,400 Ω | 33.6 V | 2.4V | 530mW |

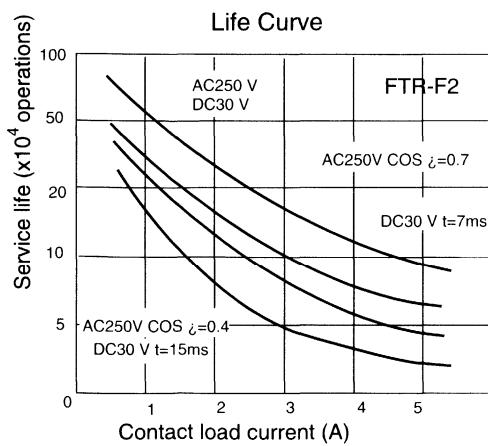
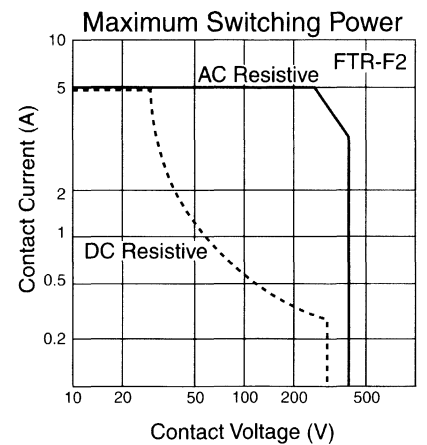
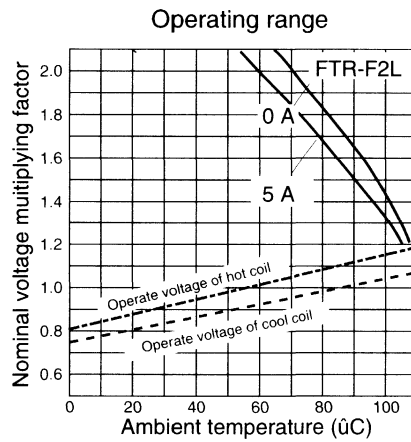
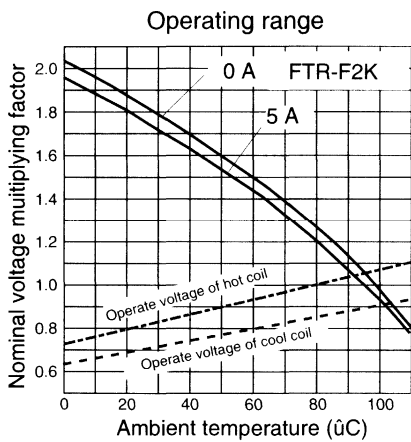
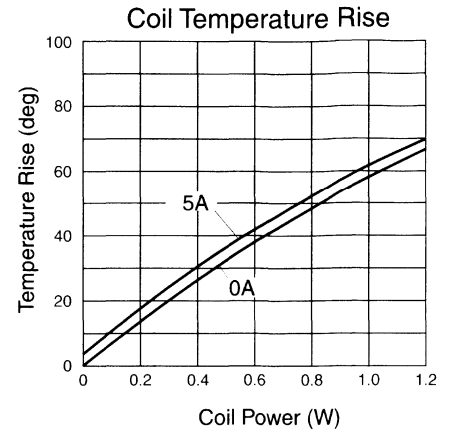
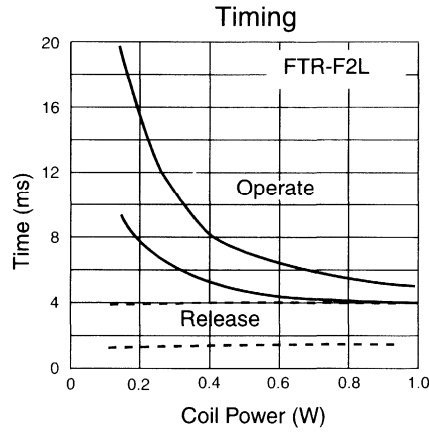
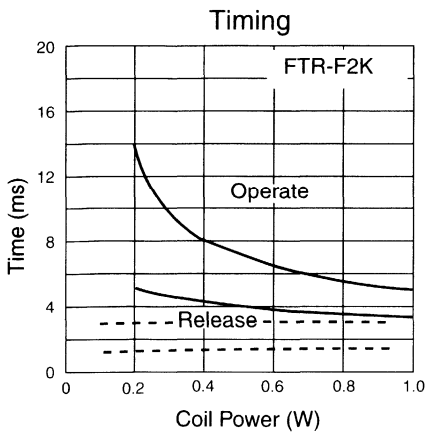
Sensitive type

| MODEL | Nominal voltage | Coil resistance | Operate voltage | Release voltage | Nominal power |
|--------------|-----------------|-----------------|-----------------|-----------------|---------------|
| FTR-F2AL005T | 5VDC | 100 Ω | 4.0 V | 0.25 V | 250mW |
| FTR-F2AL006T | 6VDC | 145 Ω | 4.8 V | 0.3V | 250mW |
| FTR-F2AL009T | 9VDC | 325 Ω | 7.2 V | 0.45V | 250mW |
| FTR-F2AL012T | 12VDC | 575 Ω | 9.6 V | 0.6V | 250mW |
| FTR-F2AL024T | 24VDC | 2,310 Ω | 19.2 V | 1.2V | 250mW |

Note: All values in the table are measured at 20°C.

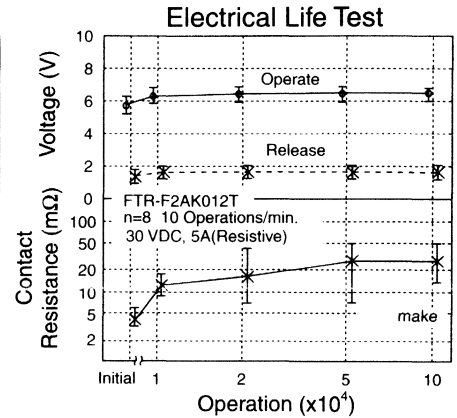
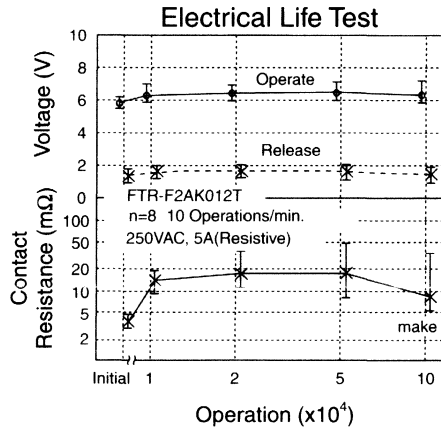
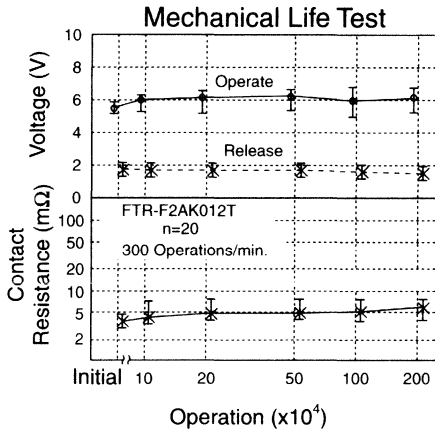
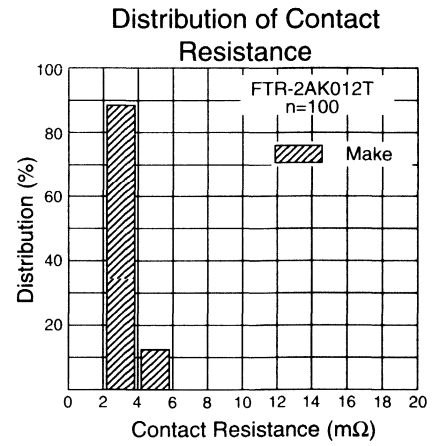
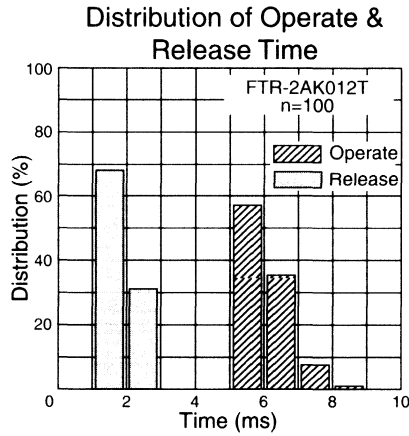
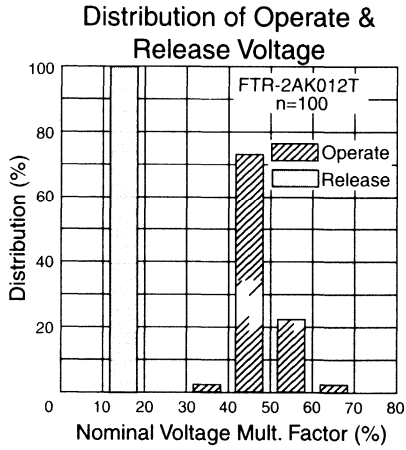
FTR-F2 SERIES

CHARACTERISTIC DATA



FTR-F2 SERIES

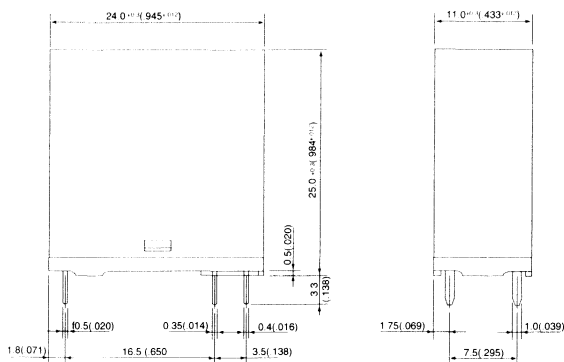
REFERENCE DATA



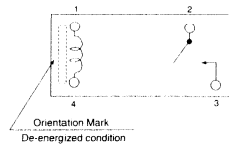
DIMENSIONS

Dimensions

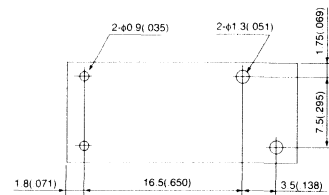
FTR-F2 type



Schematics (BOTTOM VIEW)



PC board mounting hole layout (BOTTOM VIEW)



Unit: mm

NOTES

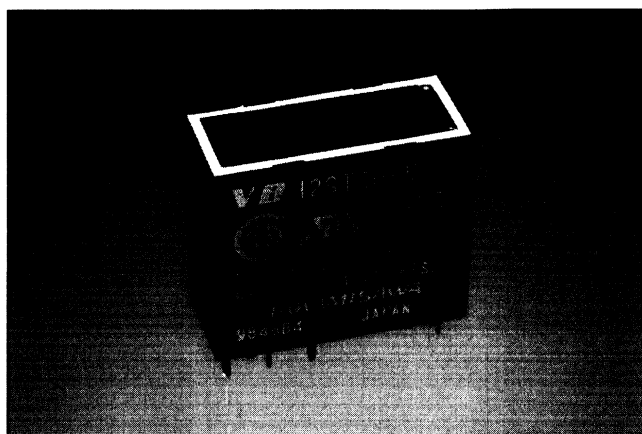
POWER RELAY

2 POLE—5 A (MEDIUM LOAD CONTROL)

VB SERIES

■ FEATURES

- UL, CSA, VDE, SEV, SEMKO, FIMKO, IMQ recognized TV-3 rated
- Working class: C
- UL class B (130°C) insulation
- Type of service: continuous duty
- Heavy duty miniature slim type power relay
- High isolation in small package
 - Insulation distance: 8 mm
 - Dielectric strength: 5,000 VAC (between coil and contacts)
 - Surge strength: 10,000 V
- Standard and high sensitivity types available
- Flux free type and plastic sealed type available



■ ORDERING INFORMATION

[Example] VB - 12 S M B U - 5
(a) (*) (b) (c) (d) (e) (f) (*) (g)

| | | |
|-----|---------------------|---|
| (a) | Series Name | VB: VB Series |
| (b) | Nominal Voltage | Refer to the COIL DATA CHART |
| (c) | Coil Type | Nil : Standard type S : High sensitive type (non TV-rating) |
| (d) | Contact Arrangement | M : 2 form A (DPST-NO) T : 2 form C (DPDT) |
| (e) | Enclosure | B : Flux free type C : Plastic sealed type (with tape) K : Plastic sealed type |
| (f) | Standard | Nil : TV-rating U : General (non TV-rating) |
| (g) | Contact Material | Nil : Silver cadmium oxide (TV-3 rating) 5 : Silver cadmium oxide (non TV-rating) Nil : Gold overlay silver-nickel (non TV-rating) E : Silver-nickel (non TV-rating) |

Actual marking omits the hyphen (-) of (*)

VB SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E56140, E108658)

C22.2 No. 1, No. 14 (File No. LR35579)

VDE0435, 0630, 0631, 0700, 0860

Please note that UL/CSA ratings may differ from the standard ratings. Please request when the approval markings are required on the cover and/or when a relay recognized by VDE, SEV, SEMKO, FIMKO, IMQ is required.

| | Type | Nominal voltage | Contact rating |
|-----------|--|-----------------|---|
| TV-Rating | VB-() M | 3 to 100 VDC | TV-3 120 VAC 1/6HP 120 VAC/240 VAC 5 A 24 VDC/240 VAC resistive Pilot duty C 150 |
| Standard | VB-() () U-() VB-() S () U-() | 3 to 100 VDC | 1/6HP 120 VAC/240 VAC 5 A 24 VDC/240 VAC resistive Pilot duty C 150 |

VB SERIES

■ SPECIFICATIONS

| Item | | TV-3 Rating VB-() M | Standard Type | |
|------------------|--|---|---|----------------------|
| | | | VB-() U-5 | VB-() U VB-()-E |
| Contact | Arrangement | 2 form A (DPST-NO) | 2 form A (DPST-NO) or 2 form C (DPDT) | |
| | Material | Silver-cadmium oxide | Gold overlay silver-nickel (non gold overlay only VB-E) | |
| | Style | Single | | |
| | Resistance (initial) (at 1 A 6 VDC) | Maximum 200 mΩ | Maximum 100 mΩ | |
| | Rating (resistive) | 5 A 240 VAC/24 VDC | | |
| | Maximum Carrying Current | 7 A | | |
| | Maximum Switching Power | 1,200 VA, 120 W | | |
| | Maximum Switching Voltage | 380 VAC, 150 VDC | | |
| | Maximum Switching Current | 5 A | | |
| | Minimum Switching Load *1 | 100 mA 5 VDC (VB-M, 5, E) 10 mA 5 VDC (VB-) | | |
| | Maximum Inrush Current | 51 A 120 VAC (at lamp load) | — | |
| Coil | Nominal Power (at 20°C) | Standard type: 0.70 to 0.75 W, high sensitivity type: 0.53 W | | |
| | Operate Power (at 20°C) | Standard type: 0.35 to 0.37 W, high sensitivity type: 0.26 W | | |
| | Operating Temperature | Standard type: -40°C to +65°C, high sensitivity type: -40°C to +75°C (no frost) | | |
| Time Value | Operate (at nominal voltage) | Maximum 20 ms | | |
| | Release (at nominal voltage) | Maximum 10 ms | | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute | |
| | | between coil and contacts*2 | 5,000 VAC 1 minute | |
| Surge Strength*3 | 10,000 V at(1.2 x 50 μs) | | | |
| Life | Mechanical | 20 x 10 ⁶ operations minimum | | |
| | Electrical | 100 x 10 ³ operations minimum at rated load | | |
| | | 50 x 10 ³ operations minimum at motor load (1/8HP 120 VAC) | 30 x 10 ³ operations minimum at motor load (1/8HP 120 VAC) | |
| | | 50 x 10 ³ operations minimum at lamp load | — | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | | Endurance | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ± 1 ms) | |
| | | Endurance | 1,000 m/s ² (6 ± 1 ms) | |
| | Weight | Approximately 17 g | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

*2 IMQ 

*3 IMQ 

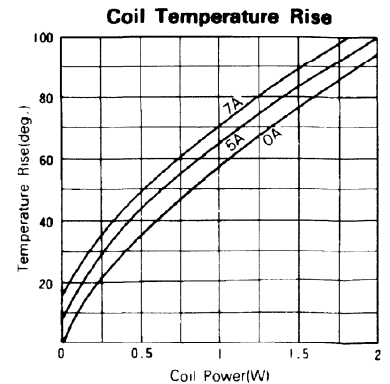
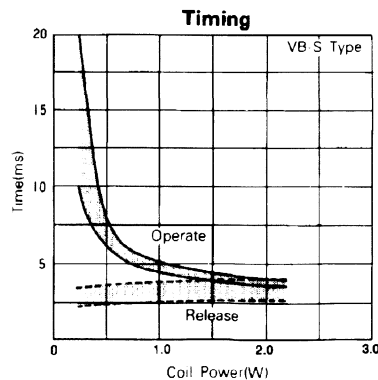
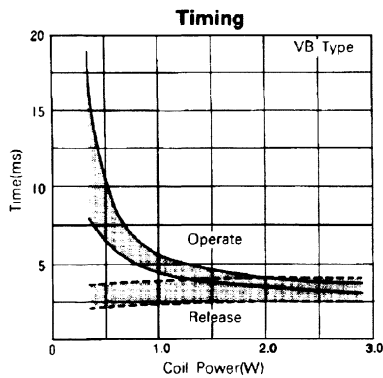
VB SERIES

COIL DATA CHART

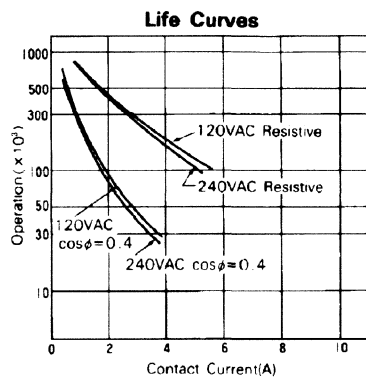
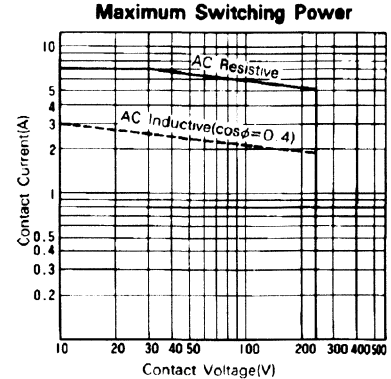
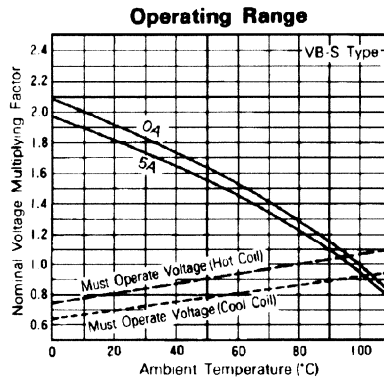
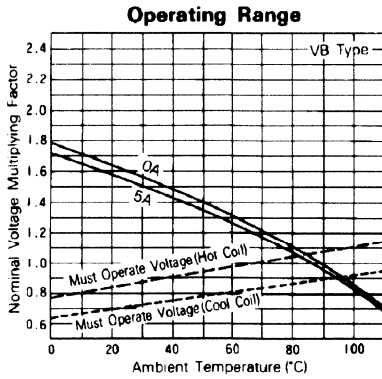
| MODEL | | Nominal voltage | Coil resistance (10%) | Must operate voltage | Must release voltage | Nominal power | |
|-----------------------|------------------------|------------------------|-----------------------|----------------------|----------------------|---------------|--------|
| TV-3 Rating | Standard | | | | | | |
| Standard Type | VB- 3M () | VB- 3 () () U- () | 3 V DC | 12.5 Ω | 2.1 VDC | 0.3 VDC | 0.72 W |
| | VB- 5M () | VB- 5 () () U- () | 5 V DC | 36 Ω | 3.5 VDC | 0.5 VDC | 0.70 W |
| | VB- 6M () | VB- 6 () () U- () | 6 V DC | 50 Ω | 4.2 VDC | 0.6 VDC | 0.72 W |
| | VB- 9M () | VB- 9 () () U- () | 9 V DC | 115 Ω | 6.3 VDC | 0.9 VDC | 0.70 W |
| | VB- 12M () | VB- 12 () () U- () | 12 V DC | 200 Ω | 8.4 VDC | 1.2 VDC | 0.72 W |
| | VB- 14M () | VB- 14 () () U- () | 14 V DC | 280 Ω | 9.8 VDC | 1.4 VDC | 0.70 W |
| | VB- 18M () | VB- 18 () () U- () | 18 V DC | 460 Ω | 12.6 VDC | 1.8 VDC | 0.70 W |
| | VB- 24M () | VB- 24 () () U- () | 24 V DC | 820 Ω | 16.8 VDC | 2.4 VDC | 0.70 W |
| | VB- 36M () | VB- 36 () () U- () | 36 V DC | 1,850 Ω | 25.2 VDC | 3.6 VDC | 0.70 W |
| | VB- 48M () | VB- 48 () () U- () | 48 V DC | 3,300 Ω | 33.6 VDC | 4.8 VDC | 0.70 W |
| | VB- 60M () | VB- 60 () () U- () | 60 V DC | 5,100 Ω | 42.0 VDC | 6.0 VDC | 0.70 W |
| | VB-100M () | VB-100 () () U- () | 100 V DC | 13,400 Ω | 70.0 VDC | 10.0 VDC | 0.75 W |
| High Sensitivity Type | VB- 3S () () U- () | VB- 3S () () U- () | 3 V DC | 17 Ω | 2.1 VDC | 0.3 VDC | 0.53 W |
| | VB- 5S () () U- () | VB- 5S () () U- () | 5 V DC | 47 Ω | 3.5 VDC | 0.5 VDC | 0.53 W |
| | VB- 6S () () U- () | VB- 6S () () U- () | 6 V DC | 68 Ω | 4.2 VDC | 0.6 VDC | 0.53 W |
| | VB- 9S () () U- () | VB- 9S () () U- () | 9 V DC | 155 Ω | 6.3 VDC | 0.9 VDC | 0.53 W |
| | VB-12S () () U- () | VB-12S () () U- () | 12 V DC | 270 Ω | 8.4 VDC | 1.2 VDC | 0.53 W |
| | VB-14S () () U- () | VB-14S () () U- () | 14 V DC | 370 Ω | 9.8 VDC | 1.4 VDC | 0.53 W |
| | VB-18S () () U- () | VB-18S () () U- () | 18 V DC | 610 Ω | 12.6 VDC | 1.8 VDC | 0.53 W |
| | VB-24S () () U- () | VB-24S () () U- () | 24 V DC | 1,100 Ω | 16.8 VDC | 2.4 VDC | 0.53 W |
| | VB-36S () () U- () | VB-36S () () U- () | 36 V DC | 2,450 Ω | 25.2 VDC | 3.6 VDC | 0.53 W |
| | VB-48S () () U- () | VB-48S () () U- () | 48 V DC | 4,400 Ω | 33.6 VDC | 4.8 VDC | 0.53 W |
| | VB-60S () () U- () | VB-60S () () U- () | 60 V DC | 6,800 Ω | 42.0 VDC | 6.0 VDC | 0.53 W |
| | VB-100S () () U- () | VB-100S () () U- () | 100 V DC | 18,860 Ω | 70.0 VDC | 10.0 VDC | 0.53 W |

Note: All values in the table are measured at 20 °C.

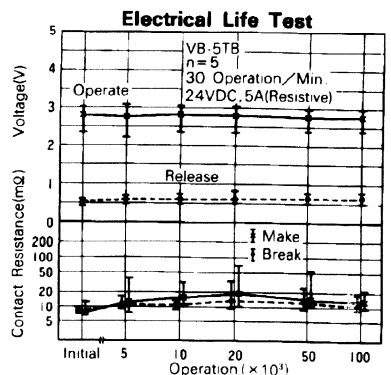
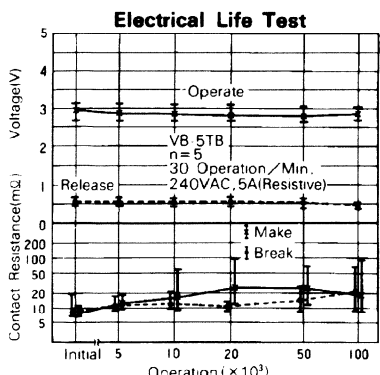
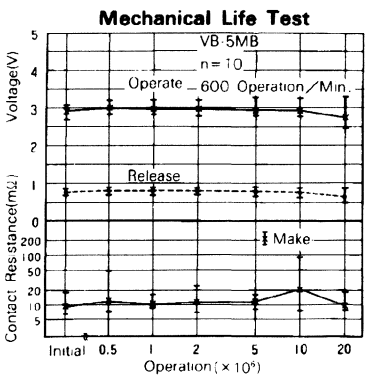
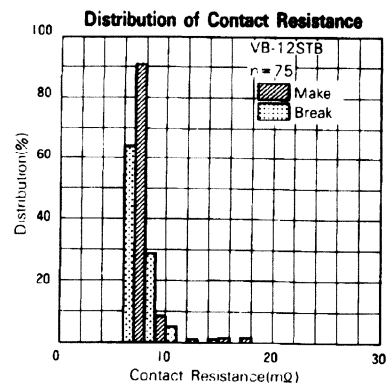
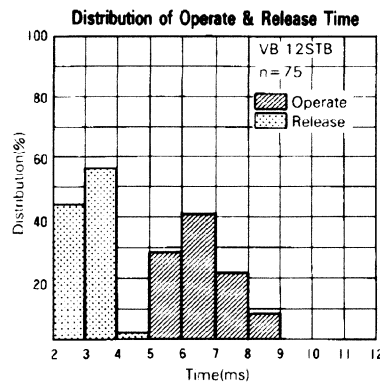
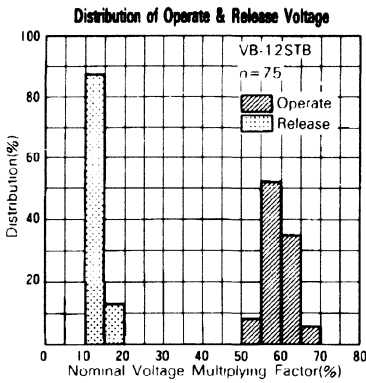
CHARACTERISTIC DATA



VB SERIES



REFERENCE DATA

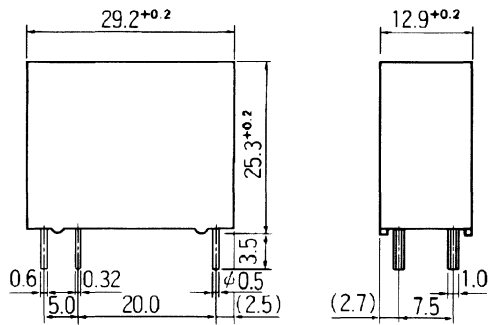


VB SERIES

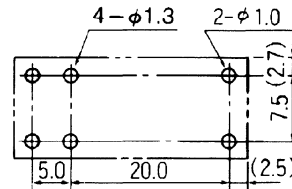
■ DIMENSIONS

● Dimensions

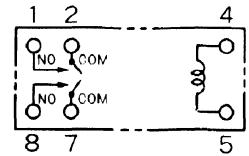
VB-M type



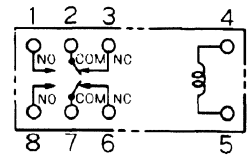
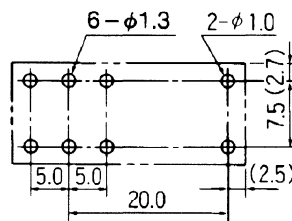
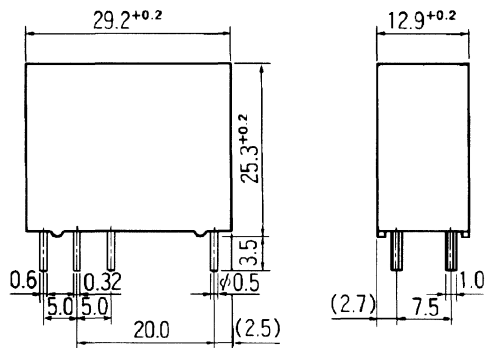
● Schematics (BOTTOM VIEW)



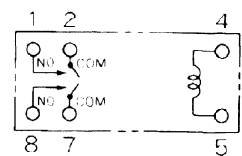
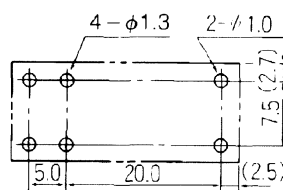
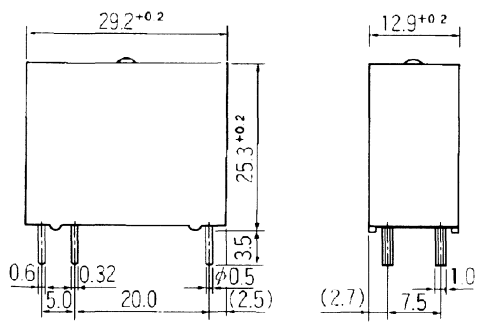
● PC board mounting hole layout (BOTTOM VIEW)



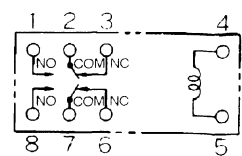
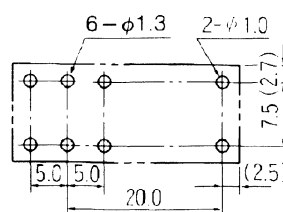
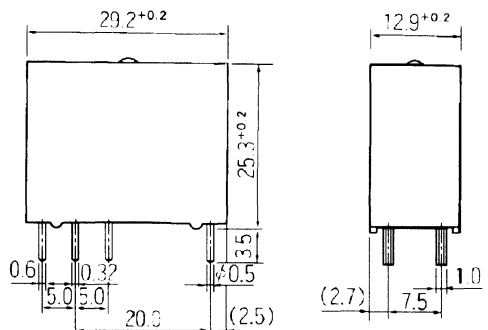
VB type



VB-MK type (Plastic sealed type)



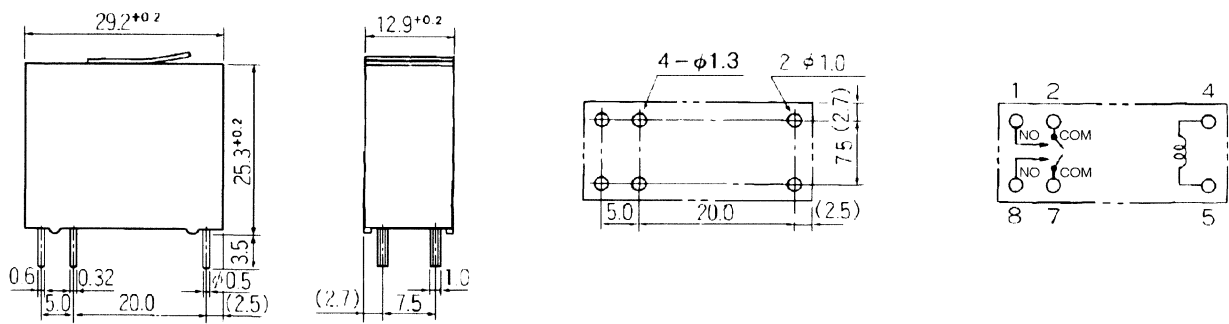
VB-K type (Plastic sealed type)



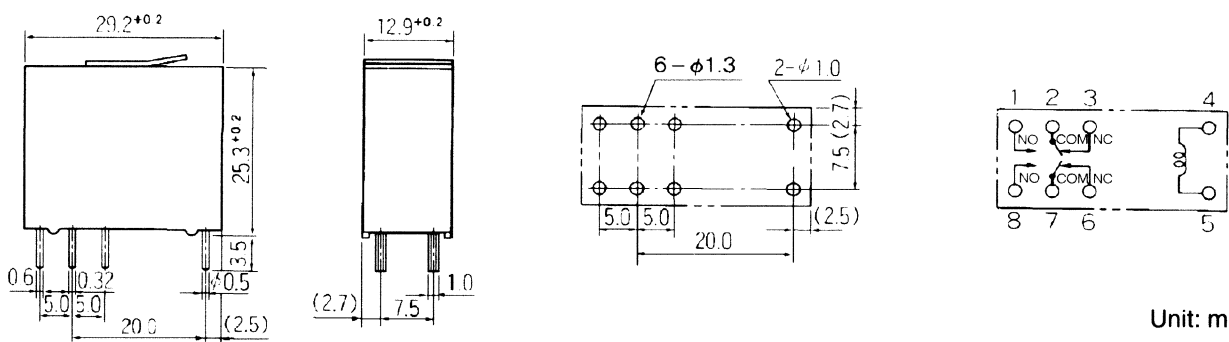
Unit: mm

VB SERIES

VB-MC type (Plastic sealed type with tape)



VB-C type (Plastic sealed type with tape)



Unit: mm

VB SERIES

NOTES

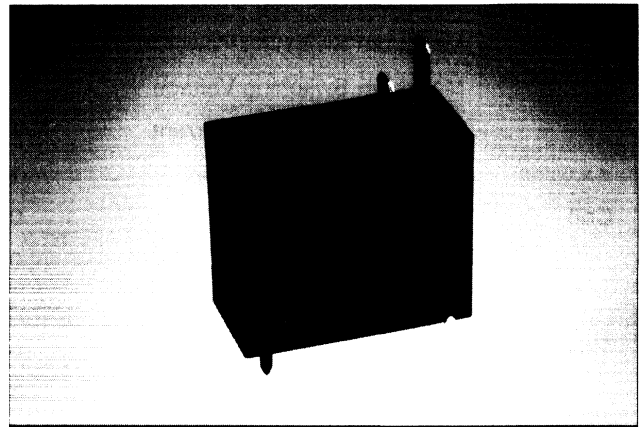


POWER RELAY

1 POLE—15 A (HEAVY POWER CONTROL) VR SERIES

■ FEATURES

- UL, CSA, VDE recognized TV-5 rated
- 1 Form A (SPST-NO) contact
- Heavy duty 15 A miniature power relay with tab-terminals (#187)
- UL class B (130°C) insulation
- High isolation and high surge strength
 - Insulation distance: 8 mm
 - Dielectric strength: 5,000 VAC (between coil and contacts)
 - Surge strength: 10,000 V
- VRB type—good for high density mounting



■ ORDERING INFORMATION

[Example] $\frac{VR}{(a)}$ $\frac{B}{(b)}$ $\frac{-}{(*)}$ $\frac{12}{(c)}$

| | | |
|-----|-----------------|--|
| (a) | Series Name | VR: VR Series |
| (b) | Terminal | Nil: Top Tab-terminal (contacts) Bottom.... PCB terminal (coil) B: Top Tab-terminal (contacts) Bottom.... PCB terminal (coil and movable contact) |
| (c) | Nominal Voltage | Refer to the COIL DATA CHART |

Actual marking omits the hyphen (-) of (*)

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E56140, E108658)
 C22.2 No. 0, No. 1, No. 14 (File No. LR35579)
 VDE0435, 0631, 0700

| Type | Nominal voltage | Contact rating | |
|-----------|-----------------|---------------------|--|
| VR VRB | 3 to 60 VDC | TV-5 1HP 15 A | 120 VAC 250 VAC 277 VAC/30 VDC resistive Pilot duty B 150 |

VR SERIES

■ SPECIFICATIONS

| Item | | VR, VRB | |
|----------------|--|--|---|
| Contact | Arrangement | 1 form A (SPST-NO) | |
| | Material | Silver-cadmium oxide | |
| | Style | Single | |
| | Resistance (initial) (at 1 A 6 VDC) | Maximum 100 mΩ | |
| | Rating (resistive) | 15 A 30 VDC/277 VAC | |
| | Maximum Carrying Current | 15 A | |
| | Maximum Switching Power | 4,155 VA, 450 W | |
| | Maximum Switching Voltage | 277 VAC, 30 VDC | |
| | Maximum Switching Current | 15 A | |
| | Minimum Switching Load *1 | 100 mA 5 VDC | |
| Coil | Nominal Power (at 20°C) | 0.8 W | |
| | Operate Power (at 20°C) | 0.36 W | |
| | Operating Temperature | -40°C to +85°C (no frost) (refer to the CHARACTERISTIC DATA) | |
| Time Value | Operate (at nominal voltage) | Maximum 15 ms | |
| | Release (at nominal voltage) | Maximum 10 ms | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute |
| | | between coil and contacts | 5,000 VAC 1 minute |
| Surge Strength | 10,000 V (at 1.2 x 50 μs) | | |
| Life | Mechanical | 5 x 10 ⁶ operations minimum | |
| | Electrical | 100 x 10 ³ operations minimum (contact rating) | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.65 mm) |
| | | Endurance | 10 to 55 Hz (double amplitude of 2.0 mm) |
| | Shock Resistance | Misoperation | 200 m/s ² (11 ± 1 ms) |
| | | Endurance | 1,000 m/s ² (6 ± 1 ms) |
| | Weight | | Approximately 24 g |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

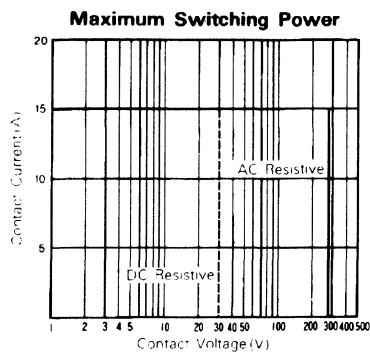
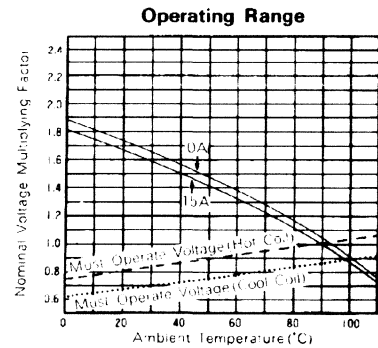
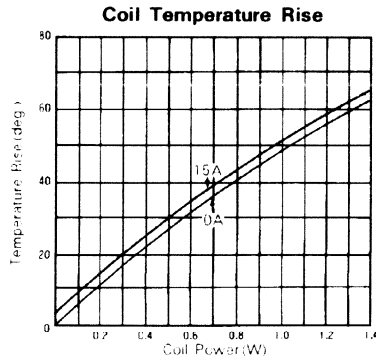
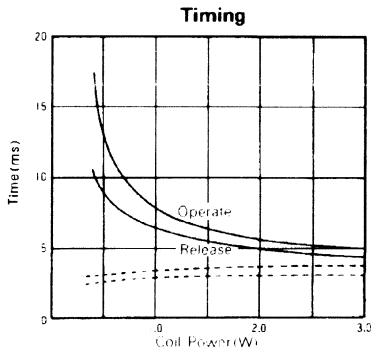
VR SERIES

■ COIL DATA CHART

| MODEL | Nominal voltage | Coil resistance (± 10%) | Must operate voltage | Must release voltage | Nominal power |
|-----------|-----------------|-------------------------|----------------------|----------------------|---------------|
| VR (B)- 3 | 3 VDC | 11.2 Ω | 2.0 VDC | 0.3 VDC | 0.8 W |
| VR (B)- 5 | 5 VDC | 31 Ω | 3.3 VDC | 0.5 VDC | 0.8 W |
| VR (B)- 6 | 6 VDC | 45 Ω | 4.0 VDC | 0.6 VDC | 0.8 W |
| VR (B)- 9 | 9 VDC | 101 Ω | 6.0 VDC | 0.9 VDC | 0.8 W |
| VR (B)-12 | 12 VDC | 180 Ω | 8.1 VDC | 1.2 VDC | 0.8 W |
| VR (B)-14 | 14 VDC | 245 Ω | 9.4 VDC | 1.4 VDC | 0.8 W |
| VR (B)-18 | 18 VDC | 405 Ω | 12.1 VDC | 1.8 VDC | 0.8 W |
| VR (B)-24 | 24 VDC | 720 Ω | 16.2 VDC | 2.4 VDC | 0.8 W |
| VR (B)-48 | 48 VDC | 2,880 Ω | 32.4 VDC | 4.8 VDC | 0.8 W |
| VR (B)-60 | 60 VDC | 4,500 Ω | 40.5 VDC | 6.0 VDC | 0.8 W |

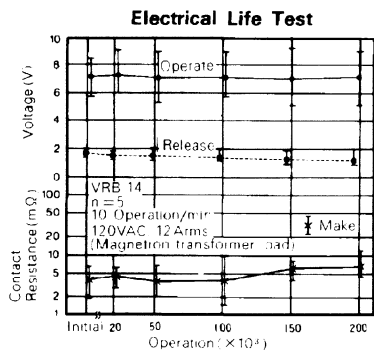
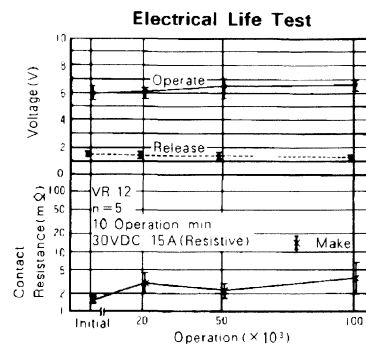
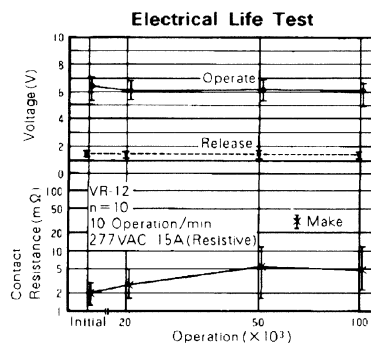
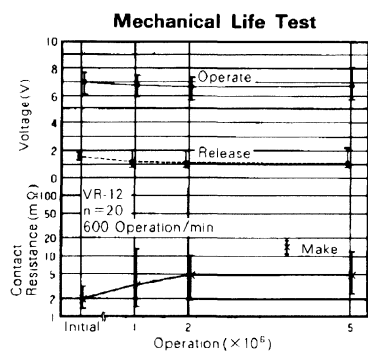
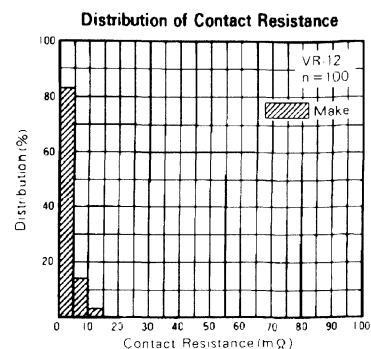
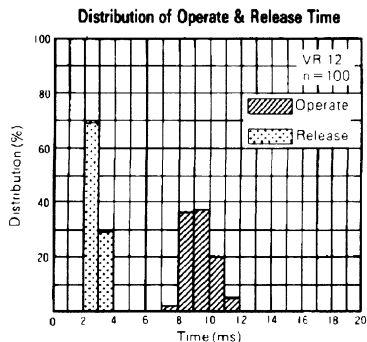
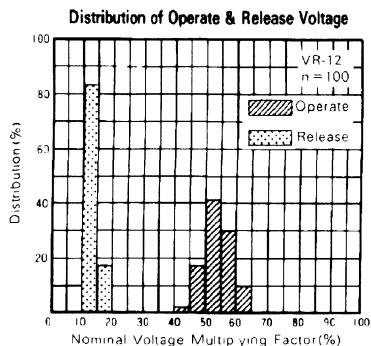
Note: All values in the table are measured at 20°C

■ CHARACTERISTIC DATA



VR SERIES

REFERENCE DATA

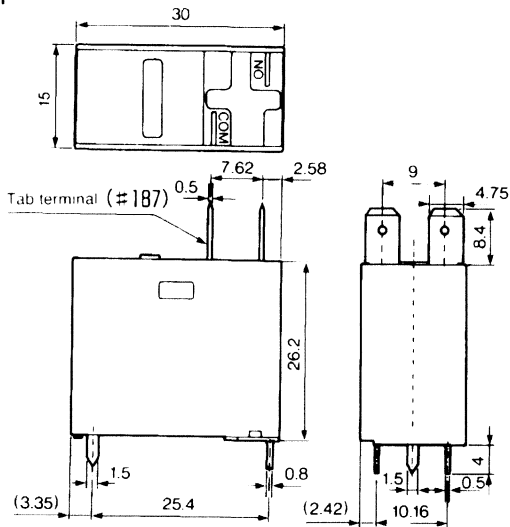


VR SERIES

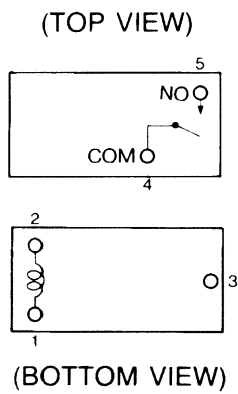
■ DIMENSIONS

● Dimensions

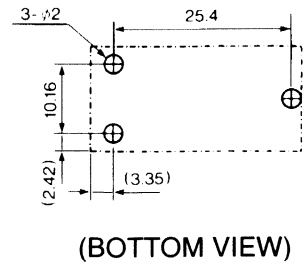
VR type



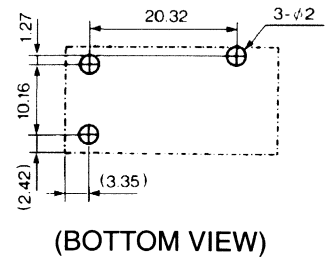
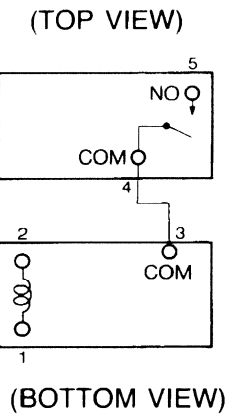
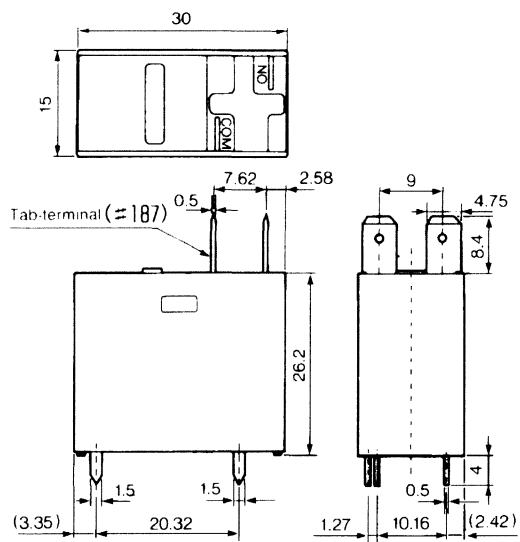
● Schematics



● PC board mounting hole layout



VRB type



Unit: mm

VR SERIES

NOTES

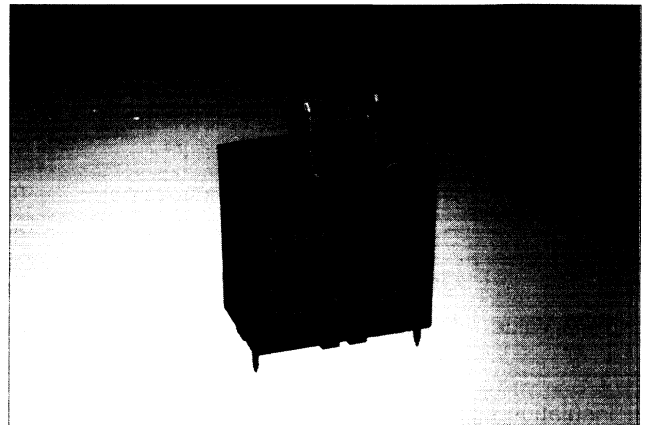


POWER RELAY

1 POLE—16 A (CADMIUM FREE CONTACTS TYPE) VH SERIES

■ FEATURES

- UL, CSA recognized TV-10 rated
- 1 Form A (SPST-NO) contact
- Heavy duty 16 A small power relay with tab-terminals (#250)
- High inrush current and high surge voltage
 - Inrush Current 55 A
 - Surge Strength 7,000 V
- Small package meets high density mounting requirement
- Environmentally friendly cadmium free contact type is available



■ ORDERING INFORMATION

[Example] VH - 12
 (a) (*) (b)

| | | |
|-----|-----------------|------------------------------|
| (a) | Series Name | VH: VH Series |
| (b) | Nominal Voltage | Refer to the COIL DATA CHART |

Actual marking omits the hyphen (-) of (*)

■ SAFETY STANDARD AND FILE NUMBERS

UL508, 873 (File No. E56140, E108658)

C22.2 No. 1, No. 14 (File No. LR35579)

Please note that UL/CSA rating may differ from the standard rating.

Please request when the approval markings are required on the cover.

| Type | Nominal voltage | Contact rating |
|------|-----------------|---|
| VH | 5 to 60 VDC | TV-10 120 VAC 1 HP 125 VAC/250 VAC 16 A 125 VAC resistive Pilot duty A 150 |

VH SERIES

■ SPECIFICATIONS

| Item | | VH | |
|----------------|--------------------------------------|---|--|
| Contact | Arrangement | 1 form A (SPST-NO) | |
| | Material | Silver-alloy | |
| | Style | Single | |
| | Resistance (initial) | Maximum 30 mΩ (at 1 A 6 VDC) | |
| | Ratings (resistive) | 16 A 250 VAC | |
| | Maximum Carrying Current | 20 A | |
| | Maximum Switching Power | 4,000 VA | |
| | Maximum Switching Voltage | 380 VAC | |
| | Maximum Switching Current | 16 A | |
| | Minimum Switching Load* ¹ | 100 mA 5 VDC | |
| Coil | Nominal Power (at 20°C) | 0.9 to 1.0 W | |
| | Operate Power (at 20°C) | 0.45 to 0.5 W | |
| | Operating Temperature | -30°C to +70°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 15 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | |
| | Dielectric Strength | between open contacts | 1,000 VAC 1 minute |
| | | between coil and contacts | 4,000 VAC 1 minute |
| Surge Strength | 7,000 V (at 1.2 x 50 μs) | | |
| Life | Mechanical | 5 x 10 ⁶ operations minimum | |
| | Electrical | 200 x 10 ³ operations minimum (contact rating) | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 3 mm) |
| | | Endurance | 10 to 55 Hz (double amplitude of 3 mm) |
| | Shock Resistance | Misoperation | 200 m/s ² (11 ±1 ms) |
| | | Endurance | 1,000 m/s ² (6 ±1 ms) |
| | Unit Mass | Approximately 35 g | |

*¹ Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

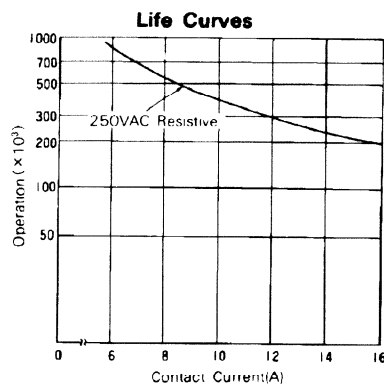
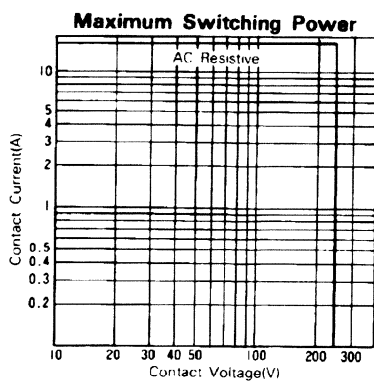
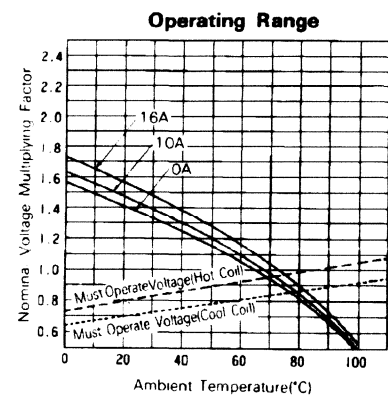
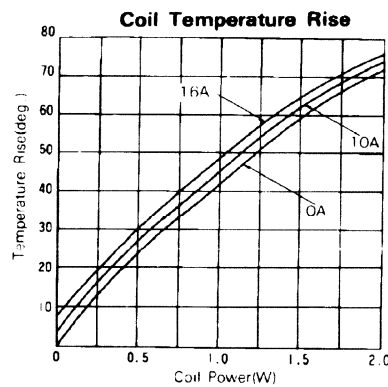
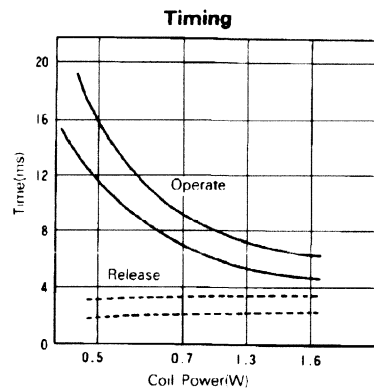
VH SERIES

■ COIL DATA CHART

| MODEL | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage | Nominal power |
|-------|-----------------|------------------------|----------------------|----------------------|---------------|
| VH- 5 | 5 VDC | 28 Ω | 3.5 VDC | 0.25 VDC | 0.9 W |
| VH- 6 | 6 VDC | 40 Ω | 4.2 VDC | 0.3 VDC | 0.9 W |
| VH- 9 | 9 VDC | 90 Ω | 6.3 VDC | 0.45 VDC | 0.9 W |
| VH-12 | 12 VDC | 160 Ω | 8.4 VDC | 0.6 VDC | 0.9 W |
| VH-18 | 18 VDC | 360 Ω | 12.6 VDC | 0.9 VDC | 0.9 W |
| VH-24 | 24 VDC | 640 Ω | 16.8 VDC | 1.2 VDC | 0.9 W |
| VH-48 | 48 VDC | 2,300 Ω | 33.6 VDC | 2.4 VDC | 1.0 W |
| VH-60 | 60 VDC | 3,600 Ω | 42.0 VDC | 3.0 VDC | 1.0 W |

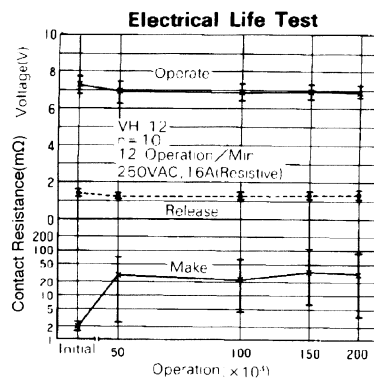
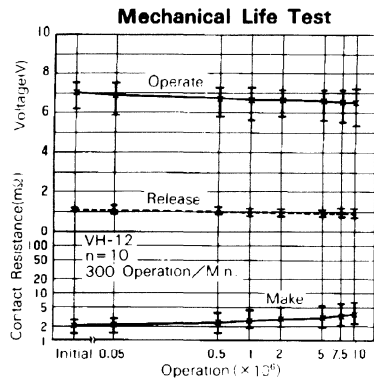
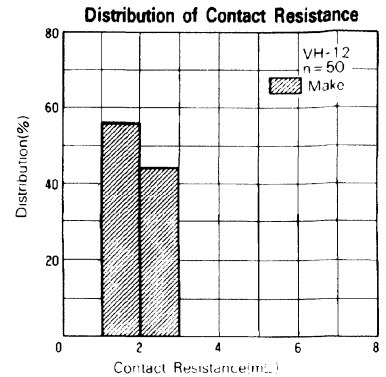
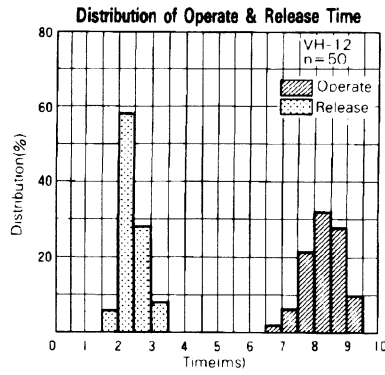
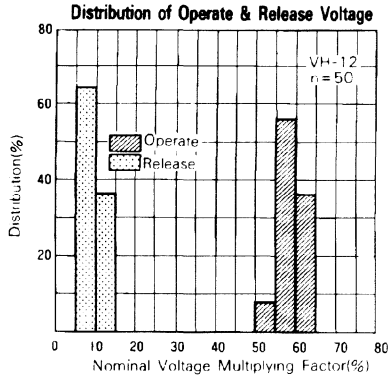
Note: All values in the table are measured at 20°C

■ CHARACTERISTIC DATA



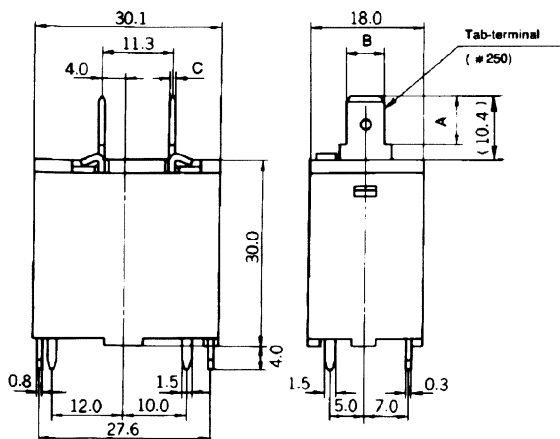
VH SERIES

REFERENCE DATA

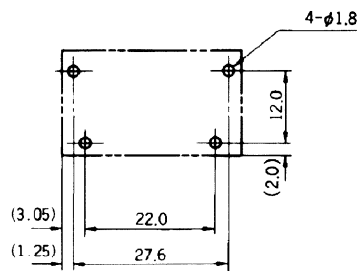


DIMENSIONS

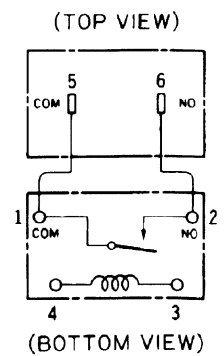
Dimensions



Schematics (BOTTOM VIEW)



PC board mounting hole layout



| Type | A | B | C |
|------|------|------|-----|
| VH | 7.95 | 6.35 | 0.8 |

Unit: mm

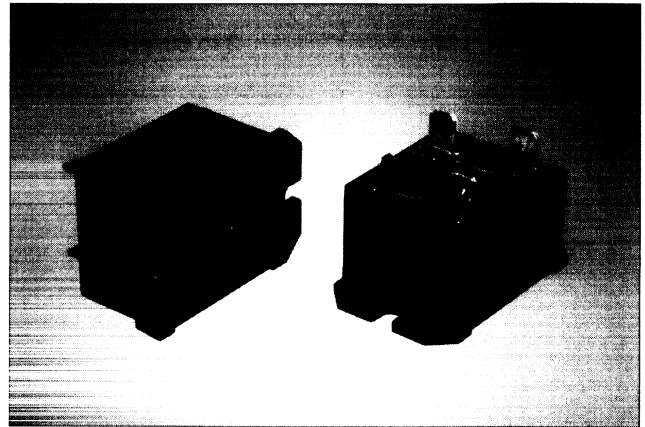
POWER RELAY

1 POLE—20, 25, 30 A (HEAVY POWER CONTROL)

VF SERIES

■ FEATURES

- UL, CSA, VDE recognized TV-15 rated
- 1 Form A (SPST-NO) contact
- Heavy duty 20 to 30 A small power relay
- High inrush current and high surge voltage
 - Inrush current 65 A
 - Surge strength 10,000 V
- Printed circuit coil terminals type available
- Small package meets high density mounting requirement



■ ORDERING INFORMATION

[Example] VF B - 6 H U
 (a) (b) (*) (c) (d) (e)

| | | |
|-----|-----------------|---|
| (a) | Series Name | VF: VF Series |
| (b) | Terminal | Nil: TopAll tab-terminal B : TopTab-terminal (contacts) : Bottom...PCB-terminal (coil and movable contact) D : TopTab-terminal (coil) Screw tight terminal (contacts) P : TopScrew tight terminal (contacts) : Bottom...PCB terminal (coil and movable contact) |
| (c) | Nominal Voltage | Refer to the COIL DATA CHARAT |
| (d) | Contact Rating | H : 30 A (only VFD, VFP type) M : 25 A L : 20 A |
| (e) | Standard | U : UL, CSA, VDE rating acquired |

Note: Actual marking omits hyphen (-) of (*)

VF SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL508, 873 (File No. E56140)

C22.2 No. 1, No. 14 (File No. LR35579)

VDE 0435

Please note that UL/CSA rating may differ from the standard rating.

| Type | Nominal voltage | Contact rating |
|-----------|-----------------|---|
| VF- () L | 3 to 60 VDC | TV-15 120 VAC 1 HP 125 VAC/250 VAC 20 A 250 VAC resistive |
| VF- () M | 3 to 60 VDC | TV-15 120 VAC 1.5 HP 250 VAC 25 A 250 VAC resistive |
| VF- () H | 3 to 60 VDC | TV-15 120 VAC 2 HP 250 VAC 30 A 250 VAC resistive |

VF SERIES

■ SPECIFICATIONS

| Item | | 30 A Type | 25 A Type | 20 A Type | |
|--------------------------|--------------------------------|--|--|----------------|--------------|
| | | VFD, VFP- () H | VF () - () M | VF () - () L | |
| Contact | Arrangement | 1 form A (SPST-NO) | | | |
| | Material | Silver alloy | | | |
| | Style | Single | | | |
| | Resistance (initial) | Maximum 30 mΩ (at 1 A 6 VDC) | | | |
| | Rating | Resistive | 30 A 250 VAC | 25 A 250 VAC | 20 A 250 VAC |
| | | Motor | 2 HP 250 VAC | 1.5 HP 250 VAC | 1 HP 250 VAC |
| | Maximum Carrying Current | 30 A | 25 A | 20 A | |
| | Maximum Switching Power | 7,500 VA | 6,250 VA | 5,000 VA | |
| | Maximum Switching Voltage | 250 VAC | | | |
| | Maximum Switching Current | 30 A | 25 A | 20 A | |
| Minimum Switching Load*1 | 100 mA 5 VDC | | | | |
| Coil | Nominal Power (at 20°C) | 1.20 to 1.25 W | | | |
| | Operate Power (at 20°C) | 1.59 to 0.62 W | | | |
| | Operating Temperature | -30°C to +65°C (no frost) (refer to the CHARACTERISTIC DATA) | | | |
| Time Value | Operate (at nominal voltage) | Maximum 20 ms | | | |
| | Release (at nominal voltage) | Maximum 5 ms | | | |
| Insulation | Resistance (at 500 VDC) | Minimum 1,000 MΩ | | | |
| | Dielectric Strength | between open contacts | 1,200 VAC 1 minute | | |
| | | between coil and contacts | 4,000 VAC 1 minute | | |
| | Surge Strength | 10,000 V (at 1.2 x 50 μs) | | | |
| Life | Mechanical | 5 x 10 ⁶ operations minimum | | | |
| | Electrical (at contact rating) | 100 x 10 ³ operations minimum (resistive load) | | | |
| | | 200 x 10 ³ operations minimum (motor load) | | | |
| Other | Vibration Resistance | Misoperation | 10 to 55 Hz (double amplitude of 1.5 mm) | | |
| | | Endurance | 10 to 55 Hz (double amplitude of 1.5 mm) | | |
| | Shock Resistance | Misoperation | 200 m/s ² (11 ± 1 ms) | | |
| | | Endurance | 1,000 m/s ² (6 ± 1 ms) | | |
| | Weight | Approximately 55 g | | | |

*1 Minimum switching loads mentioned above are reference values. Please perform the confirmation test with the actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

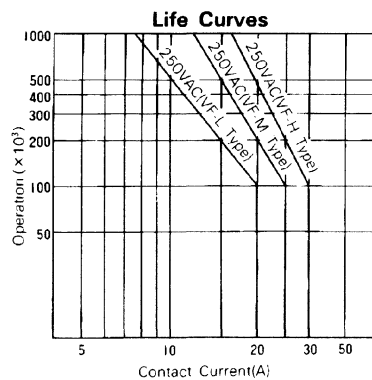
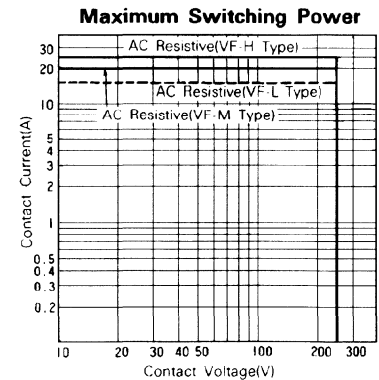
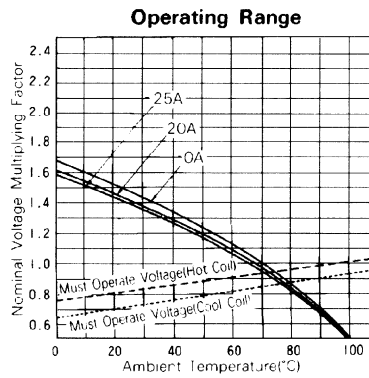
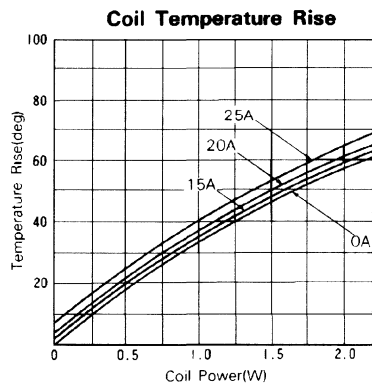
VF SERIES

COIL DATA CHART

| MODEL | | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage | Nominal power |
|-------------------|--------------|--------------|-----------------|------------------------|----------------------|----------------------|---------------|
| 30 A Type | 25 A Type | 20 A Type | | | | | |
| VF (D or P) - 3H | VF () - 3M | VF () - 3L | 3 VDC | 7.5 Ω | 2.1 VDC | 0.3 VDC | 1.2 W |
| VF (D or P) - 5H | VF () - 5M | VF () - 5L | 5 VDC | 20 Ω | 3.5 VDC | 0.5 VDC | 1.25 W |
| VF (D or P) - 6H | VF () - 6M | VF () - 6L | 6 VDC | 30 Ω | 4.2 VDC | 0.6 VDC | 1.2 W |
| VF (D or P) - 9H | VF () - 9M | VF () - 9L | 9 VDC | 67 Ω | 6.3 VDC | 0.9 VDC | 1.2 W |
| VF (D or P) - 12H | VF () - 12M | VF () - 12L | 12 VDC | 120 Ω | 8.4 VDC | 1.2 VDC | 1.2 W |
| VF (D or P) - 18H | VF () - 18M | VF () - 18L | 18 VDC | 270 Ω | 12.6 VDC | 1.8 VDC | 1.2 W |
| VF (D or P) - 24H | VF () - 24M | VF () - 24L | 24 VDC | 480 Ω | 16.8 VDC | 2.4 VDC | 1.2 W |
| VF (D or P) - 48H | VF () - 48M | VF () - 48L | 48 VDC | 1,920 Ω | 33.6 VDC | 4.8 VDC | 1.2 W |
| VF (D or P) - 60H | VF () - 60M | VF () - 60L | 60 VDC | 3,000 Ω | 42.0 VDC | 6.0 VDC | 1.2 W |

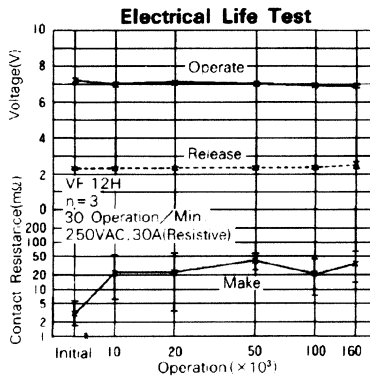
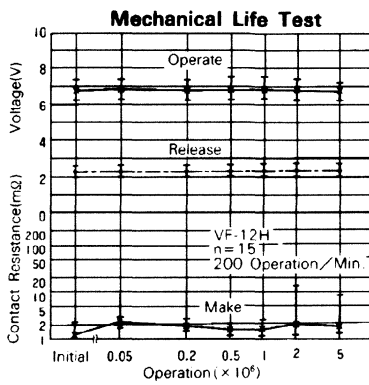
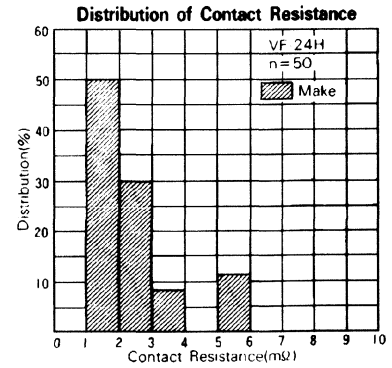
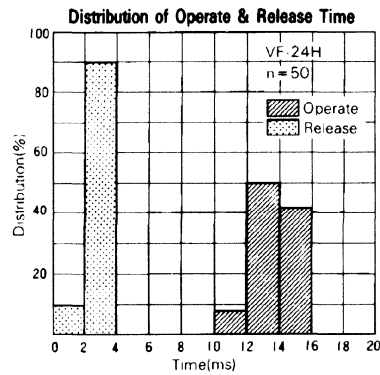
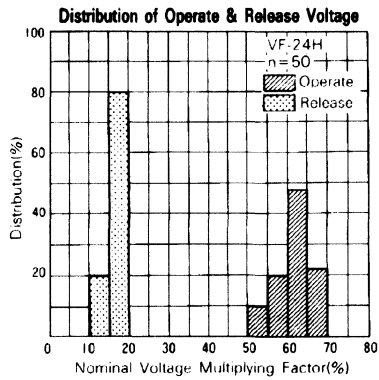
Note: All values in the table are measured at 20°C

CHARACTERISTIC DATA



VF SERIES

REFERENCE DATA



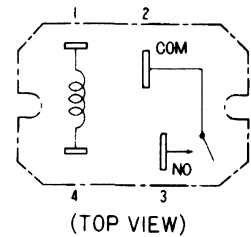
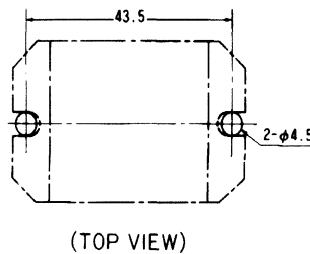
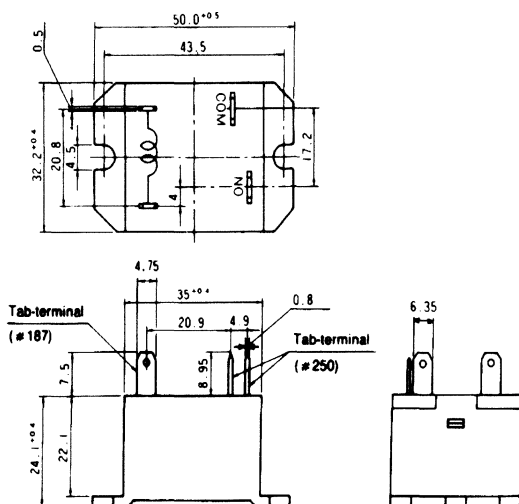
DIMENSIONS

Dimensions

Schematics

PC board mounting hole layout

VF type

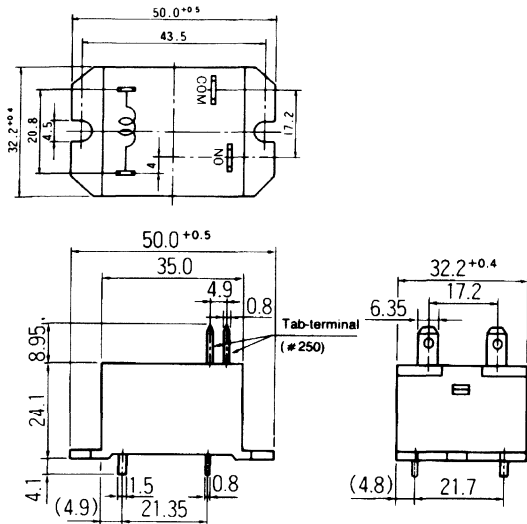


Unit: mm

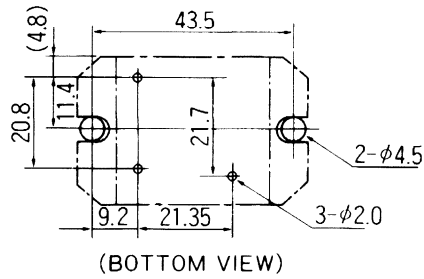
VF SERIES

● Dimensions

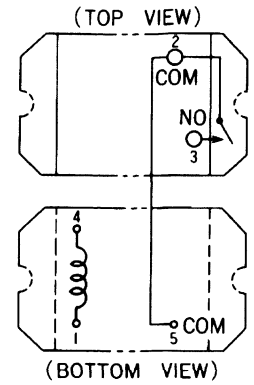
VFB type



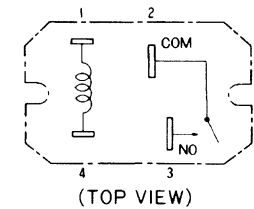
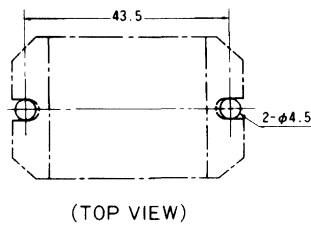
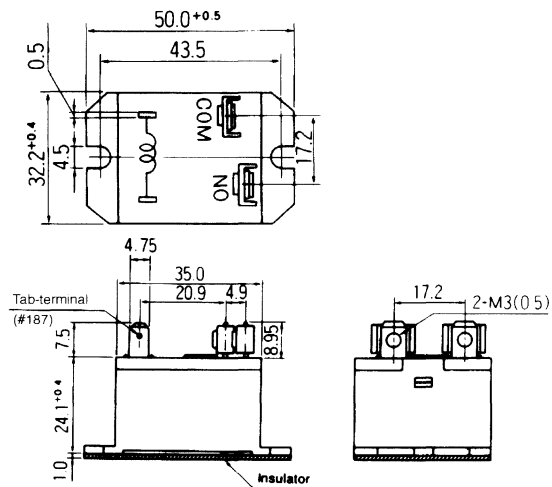
● Schematics



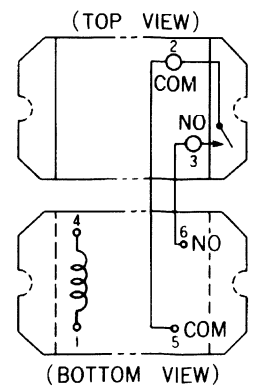
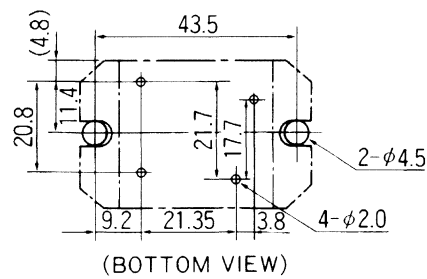
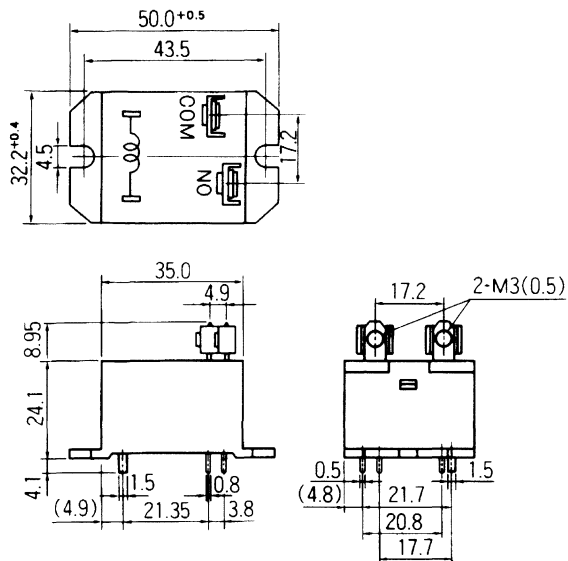
● PC board mounting hole layout



VFD type



VFP type



Unit: mm

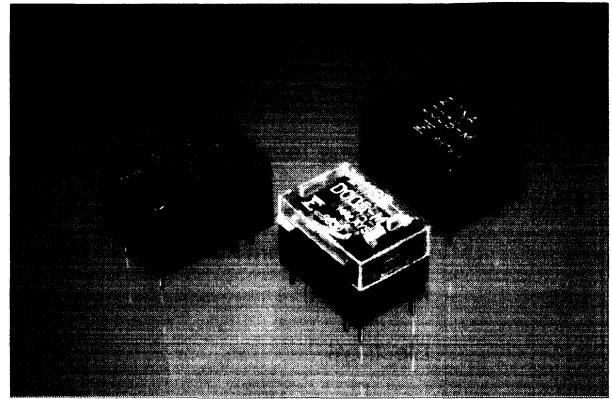
MINIATURE RELAY

1 POLE—1 to 3 A (FOR AUTOMOTIVE APPLICATIONS)

FBR211 SERIES

■ FEATURES

- Suitable for automotive applications of solenoid load controls, car audio, etc.
- Capable of 3 A/1 hour maximum carrying current in the contact.
- Superior reliability gold-overlay contact.
P type: gold-overlay silver-palladium contacts.
- High sensitivity, high temperature types also available.
Standard type: -30°C to $+60^{\circ}\text{C}$ (A or B type)
High sensitivity type: -30°C to $+80^{\circ}\text{C}$ (C or E type)



■ ORDERING INFORMATION

[Example] $\frac{\text{FBR211}}{\text{(a)}} \frac{\text{S}}{\text{(b)}} \frac{\text{A}}{\text{(c)}} \frac{\text{D012}}{\text{(d)}} - \frac{\text{P}}{\text{(e)}} \frac{\text{**}}{\text{(f)}}$

| | | |
|-----|-----------------------------------|---|
| (a) | Series Name | FBR211: FBR211 Series |
| (b) | Enclosure | S : Flux free type N : Plastic sealed type |
| (c) | Coil Specification and Schematics | A : Standard A type } (coil nominal power 0.45 W type) B : Standard B type } C : High sensitivity C type } (coil nominal power 0.2 W type) E : High sensitivity E type } |
| (d) | Nominal Voltage | D009: 9 VDC D012: 12 VDC |
| (e) | Contact Material | P : Gold overlay silver palladium |
| (f) | Custom Designation | To be assigned custom specification |

FBR211 SERIES

■ SPECIFICATIONS

| Item | | Specifications | |
|------------|------------------------------|---|------------------------|
| Contact | Arrangement | 1 form C (SPDT) | |
| | Material | Gold-overlay silver-palladium | |
| | Resistance | Maximum 100 mΩ (at 1 A 6 VDC) | |
| | Voltage Drop (Resistance) | Maximum 100 mV (at 2 A 12 VDC) | |
| | Rating | 14 VDC 2 A (locked motor load) 14 VDC inrush 8 A (condenser, lamp load) | |
| | Maximum Carrying Current | 2 A (continuously) , 3 A/1hour (25°C, 100% rated coil voltage) | |
| | Maximum Switching Current | 2 A 16 VDC (referece) | |
| Coil | Operating Temperature | Standard type: -30°C to + 60°C High sensitive type: -30°C to + 80°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 5 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Life | Mechanical | 5 x 10 ⁶ operations minimum | |
| | Electrical | 100 x 10 ³ operations minimum (14 VDC, maximum switching current, resistive load) | |
| Other | Vibration Resistance | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | Shock Resistance | Misoperation | 100 m/s ² |
| | | Endurance | 1,000 m/s ² |
| | Weight | Approximately 4 g | |

FBR211 SERIES

COIL RATINGS

1. STANDARD Type

| MODEL | | | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Nominal power | Coil temperature rise | Thermal resistance |
|----------------|---------------------|----------------|---------------------|-----------------|------------------------|------------------------------|-------------------|-----------------------|--------------------|
| A type | | B type | | | | | | | |
| Flux free type | Plastic sealed type | Flux free type | Plastic sealed type | | | | | | |
| FBR211SAD009-P | FBR211NAD009-P | FBR211SBD009-P | FBR211NBD009-P | 9 VDC | 180 Ω | 6.3 V (20°C) 7.3 V (60°C) | Approx. 450 mW | Approx. 45 deg | 100°C/W |
| FBR211SAD012-P | FBR211NAD012-P | FBR211SBD012-P | FBR211NBD012-P | 12 VDC | 320 Ω | 8.4 V (20°C) 9.7 V (60°C) | | | |

2. HIGH SENSITIVITY Type

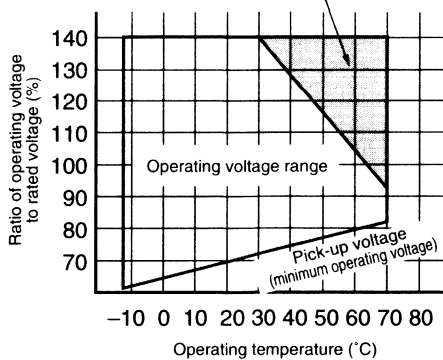
| MODEL | | | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Nominal power | Coil temperature rise | Thermal resistance |
|----------------|---------------------|----------------|---------------------|-----------------|------------------------|------------------------------|-------------------|-----------------------|--------------------|
| C type | | E type | | | | | | | |
| Flux free type | Plastic sealed type | Flux free type | Plastic sealed type | | | | | | |
| FBR211SCD009-P | FBR211NCD009-P | FBR211SED009-P | FBR211NED009-P | 9 VDC | 400 Ω | 6.3 V (20°C) 7.3 V (60°C) | Approx. 200 mW | Approx. 25 deg | 125°C/W |
| FBR211SCD012-P | FBR211NCD012-P | FBR211SED012-P | FBR211NED012-P | 12 VDC | 700 Ω | 8.4 V (20°C) 9.7 V (60°C) | | | |

Note: All values in these tables are measured at 20°C.

CHARACTERISTIC DATA

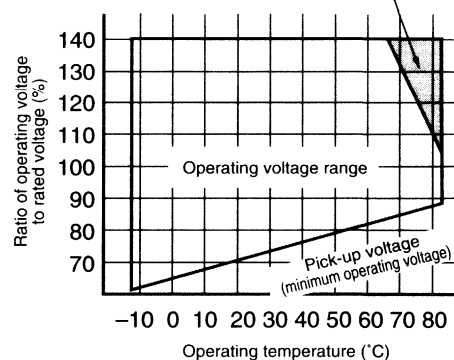
[Standard type (coil 0.45 W type)]

NOTE : Intermittent coil operation is required in this region at 2 A or more carrying current.



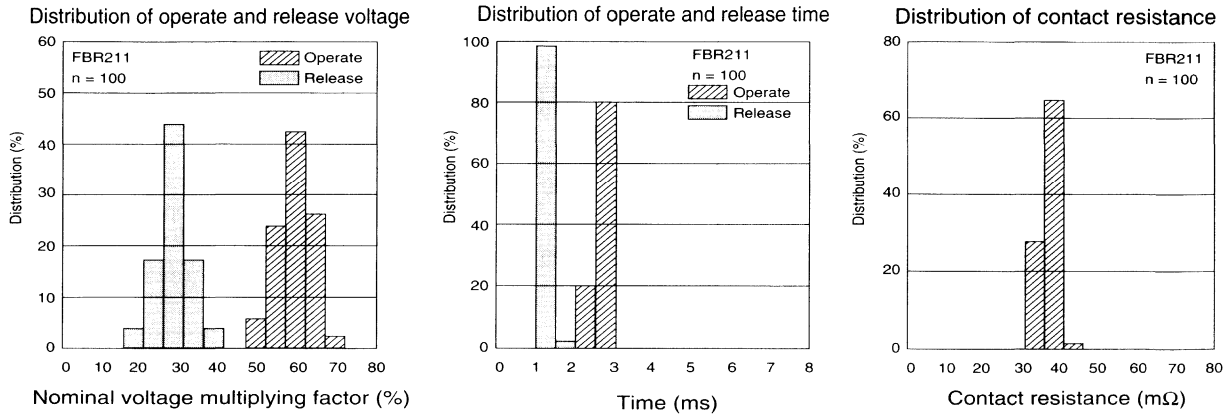
[High sensitivity type (coil 0.2 W type)]

NOTE : Intermittent coil operation is required in this region at 2 A or more carrying current.

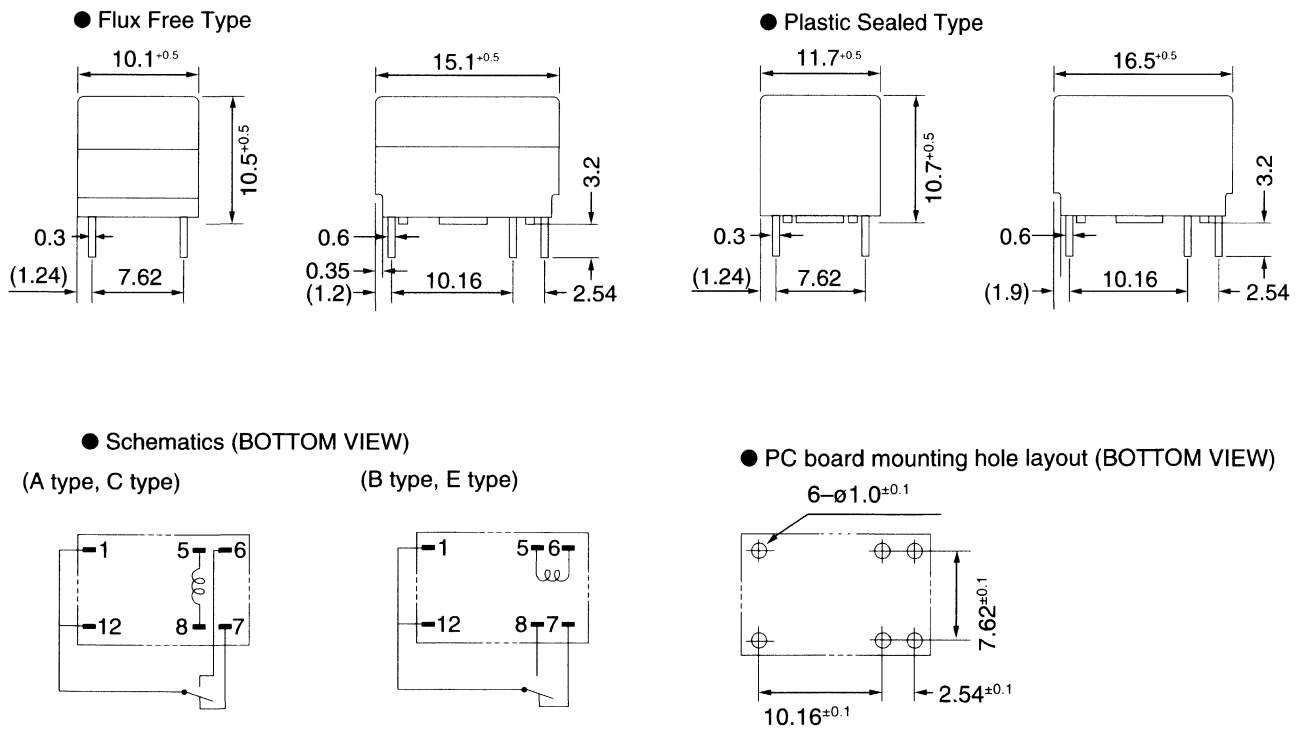


FBR211 SERIES

REFERENCE DATA



DIMENSIONS



Unit: mm

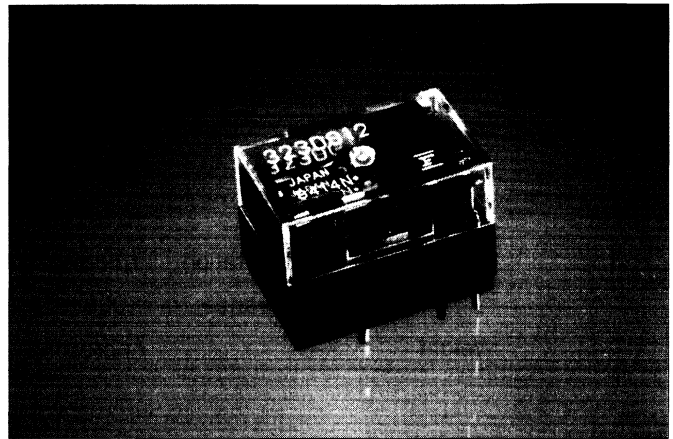
POWER RELAY

2 POLES—3 to 6 A (FOR AUTOMOTIVE APPLICATIONS)

FBR321 SERIES

■ FEATURES

- Suitable for motor load controls of car antenna.
- Capable of 6 A/1hour maximum carrying current in the contact.



■ ORDERING INFORMATION

[Example] $\frac{\text{FBR321}}{\text{(a)}} \frac{\text{N}}{\text{(b)}} \frac{\text{D012}}{\text{(c)}} - \frac{\text{Y}}{\text{(d)}} \frac{\text{**}}{\text{(e)}}$

| | | |
|-----|--------------------|---|
| (a) | Series Name | FBR321: 2 form C FBR321 Series |
| (b) | Enclosure | Nil : Flux free type N : Plastic sealed type |
| (c) | Nominal Voltage | D009 : 9 VDC D012 : 12 VDC |
| (d) | Contact Material | Y : Silver-tin oxide |
| (e) | Custom Designation | To be assigned custom specification |

FBR321 SERIES

■ SPECIFICATIONS

| Item | | FBR321 | |
|------------|------------------------------|---|--|
| Contact | Arrangement | 2 form C (DPDT) | |
| | Material | Silver-tin oxide | |
| | Voltage Drop (Resistance) | Max. 100 mV (at 6 VDC 1 A) | |
| | Maximum Carrying Current | 4 A (continuously) , 6 A/1 hour (25°C,100% rated coil voltage) | |
| | Maximum Switching Current | 4 A 16 VDC (reference) | |
| Coil | Operating Temperature | -30°C to +80°C (no frost) (refer to the CHARACTERISTIC DATA) | |
| Time Value | Operate (at nominal voltage) | Max. 20 ms | |
| | Release (at nominal voltage) | Max. 10 ms | |
| Life | Mechanical | 10 x 10 ⁶ ops. min. | |
| | Electrical | 100x10 ³ ops. min. (14 VDC, maximum switching current, resistive load) | |
| Other | Vibration Resistance | | 10 to 55 Hz (double amplitude of 1.5 mm) |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ±1 ms) |
| | | Endurance | 1,000 m/s ² (11 ±1 ms) |
| | Weight | | Approximately 12 g |

■ COIL RATINGS

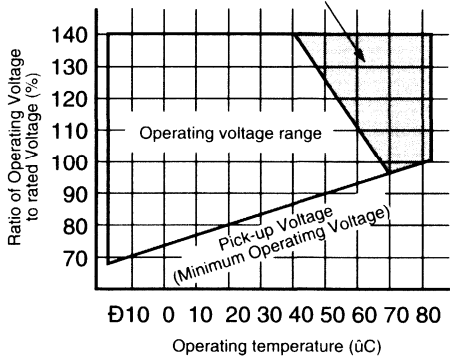
| MODEL | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Nominal power | Coil temperature rise | Thermal resistance |
|----------------|---------------------|-----------------|------------------------|-------------------------------|-------------------|-----------------------|--------------------|
| Flux free type | Plastic sealed type | | | | | | |
| FBR321D009-Y | FBR321ND009-Y | 9 VDC | 135 Ω | 7.2 V (20°C) 8.9 V (80°C) | Approx. 600 mW | Approx. 45 deg | 75°C/W |
| FBR321D012-Y | FBR321ND012-Y | 12 VDC | 230 Ω | 9.6 V (20°C) 11.9 V (80°C) | | | |

Note: All values in the table are measured at 20°C.

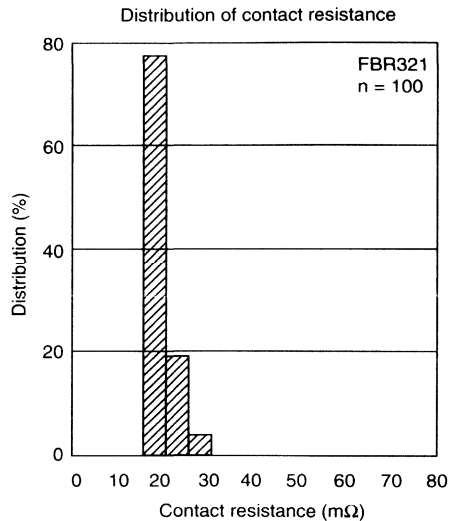
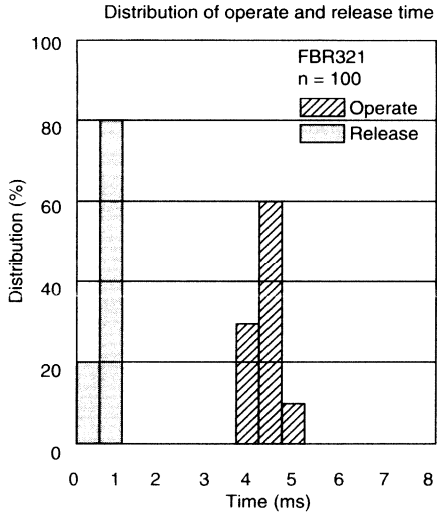
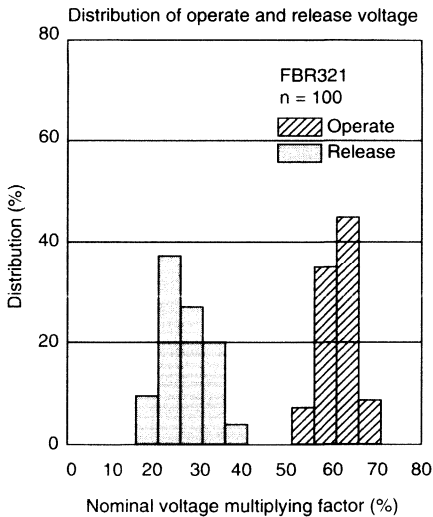
FBR321 SERIES

CHARACTERISTIC DATA

NOTE : Intermittent coil operation is required in this region at 2 A or more carrying current.



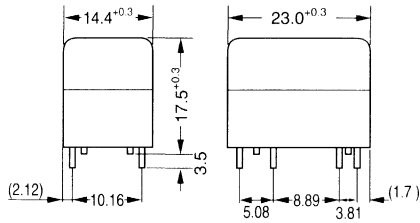
REFERENCE DATA



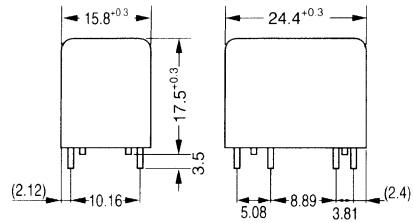
FBR321 SERIES

■ DIMENSIONS

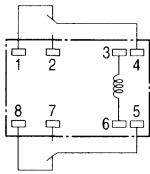
● Flux free type



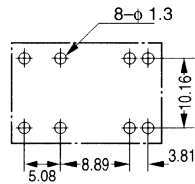
● Plastic sealed type



● Schematic (BOTTOM VIEW)



● PC board mounting hole layout (BOTTOM VIEW)



Unit: mm

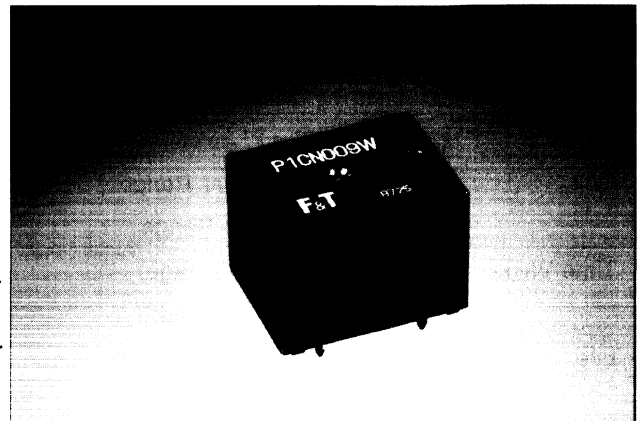
QUIET POWER RELAY

1 POLE—20 A (FOR AUTOMOTIVE APPLICATIONS)

FTR-P1 SERIES

■ FEATURES

- Original construction, where reduction of operational noise is considered when mounted on PCB, made it possible to design this quiet relay.
(Average acoustic noise level: 53 dB, distance 10 cm)
- New types of materials are used for the conductive parts, allowing this compact relay to carry 20 AMP.
- Two types of contact material are available for various contact loads.
- Wider contact gap (0.6 mm) version is also available for enhanced cut-off ability to overload condition.



■ ORDERING INFORMATION

[Example] FTR-P1 C N 012 N ---
(a) (b) (c) (d) (e) (f)

| | | |
|-----|---------------------|---|
| (a) | Series Name | FTR-P1: FTR-P1 Relay |
| (b) | Contact Arrangement | C : 1 form C (SPDT) |
| (c) | Contact Gap | N : 0.3 mm gap P : 0.6 mm gap |
| (d) | Nominal Voltage | 009 : 9 VDC 010 : 10 VDC 012 : 12 VDC |
| (e) | Contact Material | N : Silver-copper-nickel W : Silver-tin oxide-indium |
| (f) | Custom Designation | To be assigned for custom specification |

Note: Part No. is printed on the top of relay as follows.
(Example) Designation ordered: FTR-P1CN012N
Stamp: P1CN012N

FTR-P1 SERIES (QUIET TYPE)

■ SPECIFICATIONS

| Item | | Specifications | |
|------------|------------------------------------|--|--|
| Contact | Arrangement | 1 form C (SPDT) | |
| | Material | Silver-copper-nickel alloy (N type) Silver-tin oxide-indium (W type) | |
| | Voltage Drop (resistance) | Maximum 100 mV (at 2 A 12 VDC) | |
| | Ratings | 14 VDC/20 A (locked motor load) 14 VDC/inrush 20 A, break 4 A (motor free load) | |
| | Maximum Carrying Current | 20 A/ 1 hour (25°C, 100% rated coil voltage) | |
| | Maximum Inrush Current (reference) | N Type: 40 A W Type: 60 A | |
| | Max. Switching Current (reference) | 30 A at 16 VDC | |
| | Min. Switching Load*1 (reference) | 6 VDC 1 A | |
| Coil | Operating Temperature Range | -40°C to +85°C (no frost) (refer to the CHARACTERISTIC DATA) | |
| | Storage Temperature Range | -40°C to +100°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | |
| | Electrical | 200 x 10 ³ operations minimum (locked motor load) 400 x 10 ³ operations minimum (motor free load) | |
| Other | Vibration Resistance | | 10 to 55 Hz (double amplitude of 1.5 mm) |
| | Shock Resistance | Misoperation | 100 m/s ² |
| | | Endurance | 1,000 m/s ² |
| | Weight | | Approximately 10.0 g |

*1 Values when switching a resistive load at normal room temperature and humidity, and in a clean environment. The minimum applicable load varies with the switching frequency and operating environment.

■ COIL DATA CHART

● 0.3 mm contact gap type

| MODEL | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage | Thermal resistance |
|--------------|--------------|-----------------|------------------------|------------------------------------|----------------------|--------------------|
| N TYPE | W TYPE | | | | | |
| FTR-P1CN009N | FTR-P1CN009W | 9 VDC | 135 Ω | 5.4 V (at 20°C) 6.8 V (at 85°C) | 0.7 V | 73°C/W |
| FTR-P1CN010N | FTR-P1CN010W | 10 VDC | 180 Ω | 6.3 V (at 20°C) 7.9 V (at 85°C) | 0.8 V | |
| FTR-P1CN012N | FTR-P1CN012W | 12 VDC | 240 Ω | 7.3 V (at 20°C) 9.0 V (at 85°C) | 0.9 V | |

FTR-P1 SERIES (QUIET TYPE)

● 0.6 mm Contact Gap Type

| MODEL | | Nominal voltage | Coil resistance (±10%) | Must operate voltage | Must release voltage | Thermal resistance |
|--------------|--------------|-----------------|------------------------|------------------------------------|----------------------|--------------------|
| N TYPE | W TYPE | | | | | |
| FTR-P1CP009N | FTR-P1CP009W | 9 VDC | 100 Ω | 5.4 V (at 20°C) 6.8 V (at 85°C) | 0.7 V | 65°C/W |
| FTR-P1CP010N | FTR-P1CP010W | 10 VDC | 135 Ω | 6.3 V (at 20°C) 7.9 V (at 85°C) | 0.8 V | |
| FTR-P1CP012N | FTR-P1CP012W | 12 VDC | 180 Ω | 7.3 V (at 20°C) 9.0 V (at 85°C) | 0.9 V | |

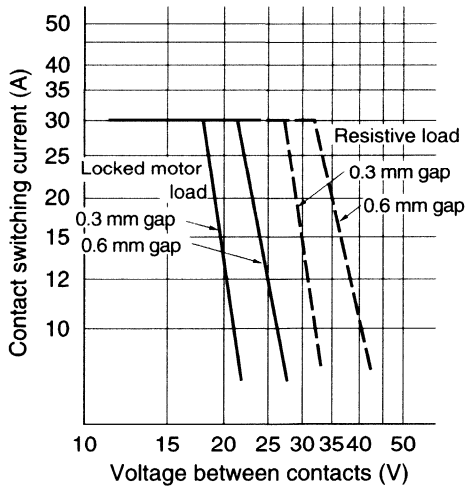
Note: Values in the table of coil resistance and must release voltage are measured at 20°C.

■ SUITABLE APPLICATION

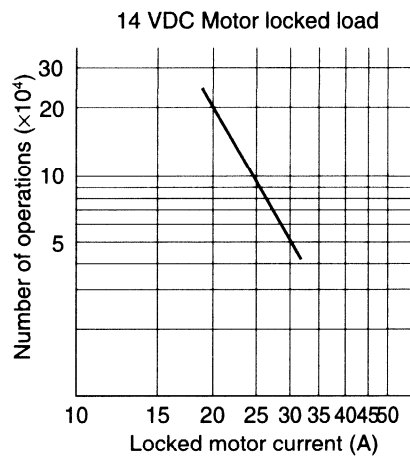
| CONTACT MATERIAL | SUITABLE LOAD |
|----------------------------|---|
| N: Silver-copper-nickel | Intermittent wiper |
| W: Silver-tin oxide-indium | Door lock Power window Solenoids, etc. (locked rotor) |

■ CHARACTERISTIC DATA

1. MAXIMUM BREAK CAPACITY



2. LIFE

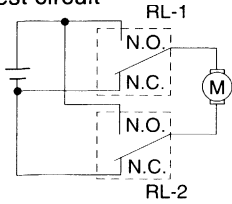


FTR-P1 SERIES (QUIET TYPE)

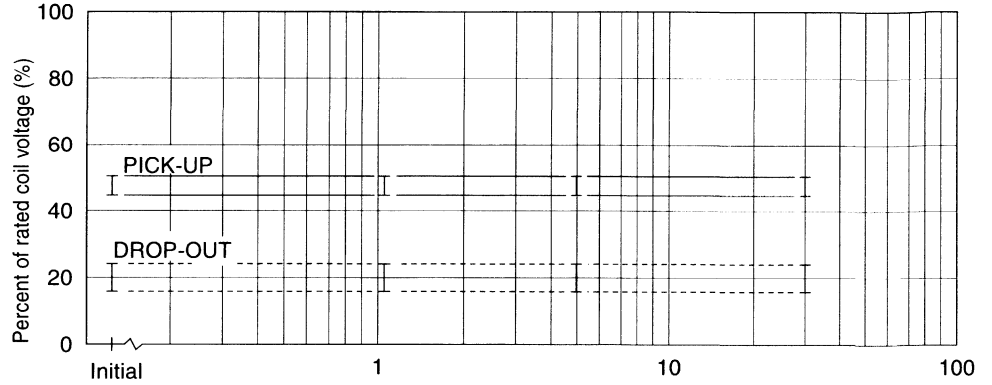
3. LIFE TEST (EXAMPLE)

- Test item
14 V DC-20 A
Motor Lock
200,000 operations
minimum

• Test circuit

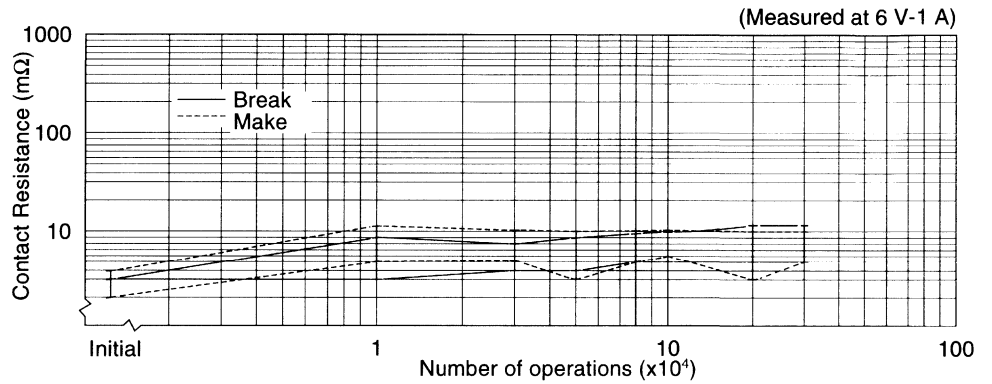
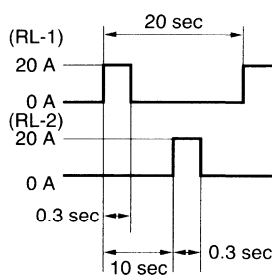


• Shift of pick-up drop-out voltage



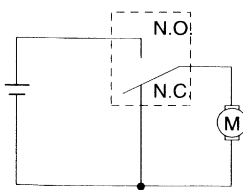
• Shift of contact resistance

• Current wave form

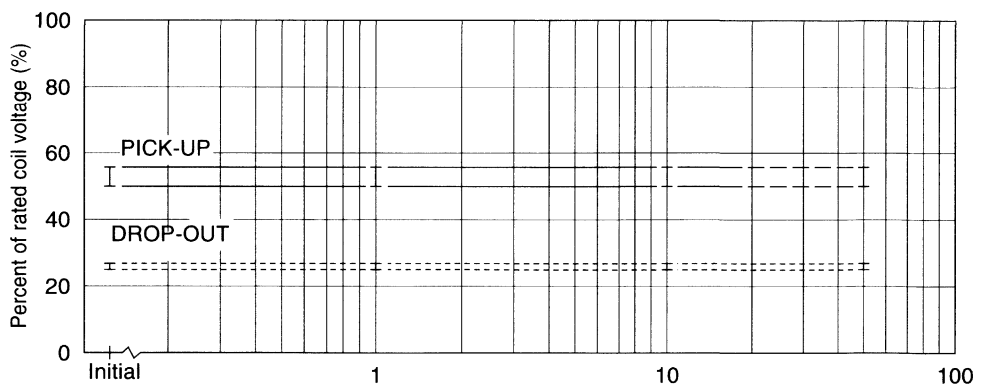


- Test item
14 V DC-20 A
motor free
400,000 operations
minimum

• Test circuit

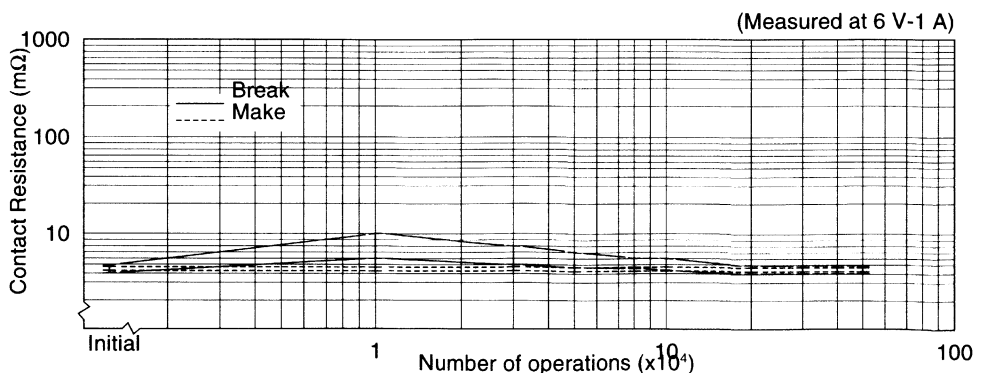
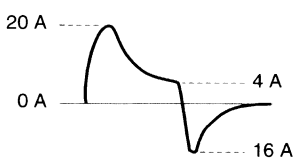


• Shift of pick-up drop-out voltage



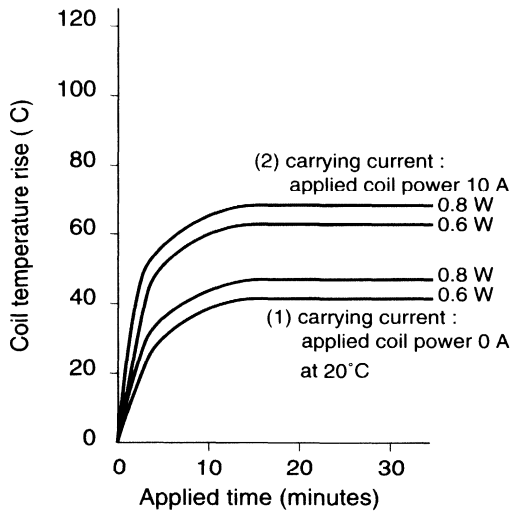
• Shift of contact resistance

• Current wave form

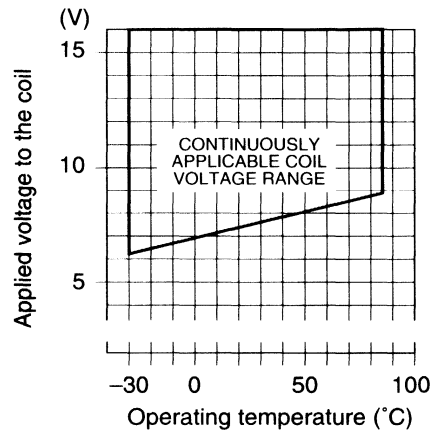


FTR-P1 SERIES (QUIET TYPE)

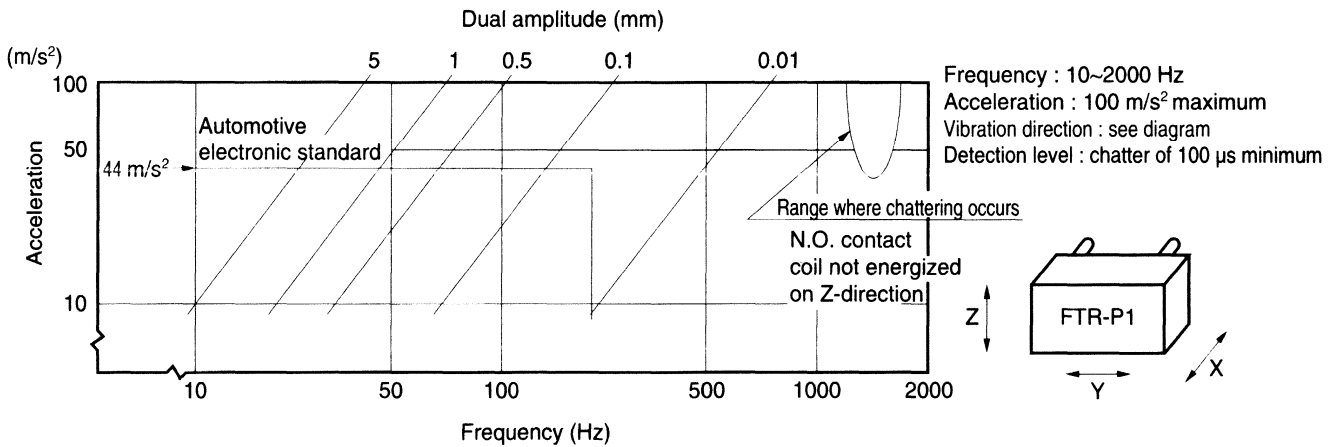
4. COIL TEMPERATURE RISE



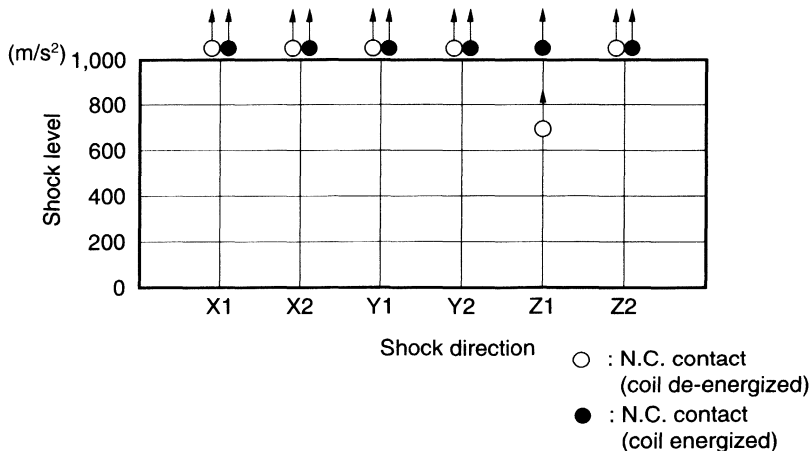
5. OPERATING COIL VOLTAGE RANGE (EXAMPLE)



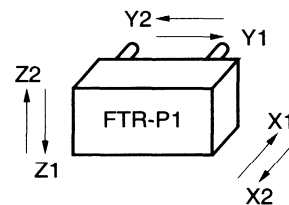
6. VIBRATION RESISTANCE CHARACTERISTICS



7. SHOCK RESISTANCE CHARACTERISTICS

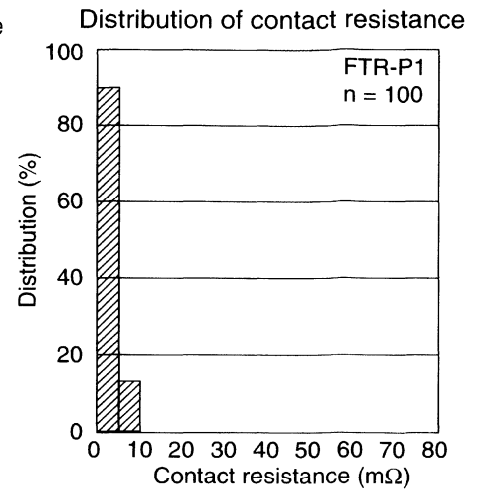
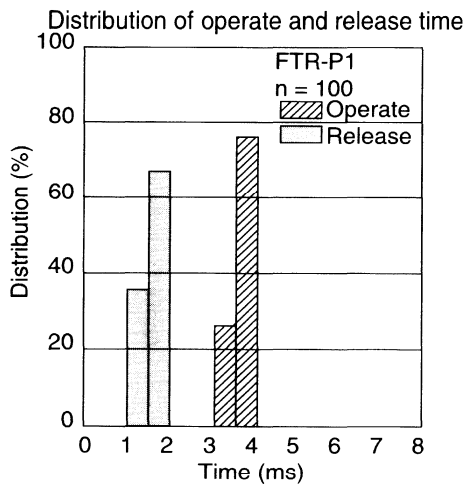
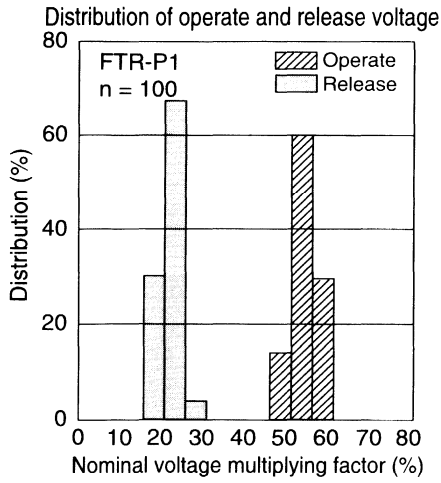


Shock application time : 11 ms, half-sine wave
Test material : coil, energized and de-energized
Shock direction : see diagram
Detection level : chatter of 100 μs minimum



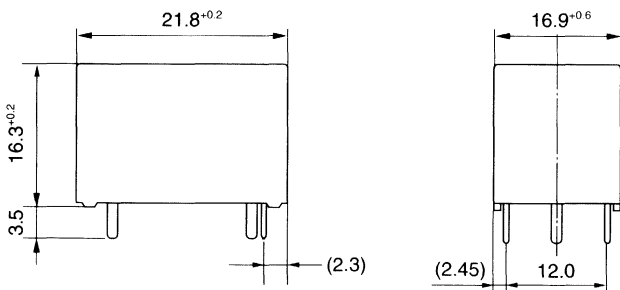
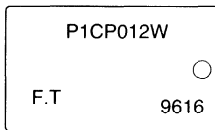
FTR-P1 SERIES (QUIET TYPE)

REFERENCE DATA

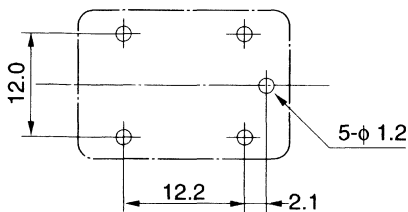


DIMENSIONS

Dimensions

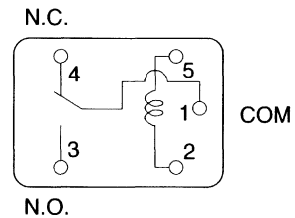


Mounting hole layout (BOTTOM VIEW)



Tolerance ± 0.1

Schematic (BOTTOM VIEW)



Unit : mm

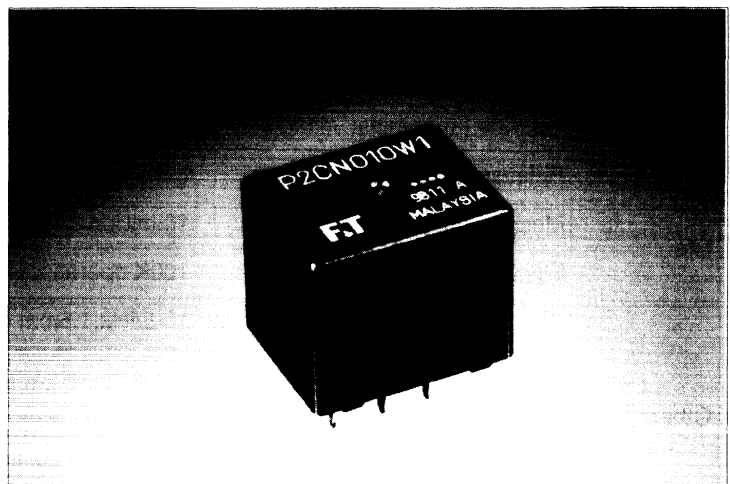
SILENT TWIN RELAY FOR AUTOMOTIVE APPLICATIONS

1 POLE X 2, H-BRIDGE, 25 A

FTR-P2 SERIES

■ FEATURES

- Low operating sound
An original silent mechanism decreases the propagation of operating sound when mounted on a PCB. (Average sound pressure: 50dB at 5 cm).
- Compact, high density package
350 mm² mounting area. (11% less than the FBR 510 series non-quiet twin relay).
- High sensitivity, low power consumption
(nominal power consumption: 450 mW).
- High capacity
Heat dissipation is high due to a single cover structure.
- Ease of PCB layout
The FTR-P2 incorporates internal H-Bridge connections typically used in reversing applications. All terminals are on the perimeter.
- High breaking capability.
In addition to the standard gap product (0.3 mm), a higher gap product (0.6 mm), suitable for over voltage breaking can be supplied.
- Typical applications
Power window
Doorlock
Power seat
Wiper (for H-Bridge circuit)



■ ORDERING INFORMATION

[Example] FTR-P2 C N 012 W1 **
 (a) (b) (c) (d) (e) (f)

| | | | |
|-----|-------------------------------|---|---------------------------------|
| (a) | Series Name | FTR-P2 | : FTR-P2 Series |
| (b) | Contact Arrangement | C | : 1 FormC x 2 |
| (c) | Contact Gap | N | : 0.3 mm gap |
| (d) | Nominal Voltage | 009 010 012 | : 9 VDC : 10 VDC : 12 VDC |
| (e) | Contact Material | W1 | : Silver-Tin-Oxide-Indium Oxide |
| (f) | Special product specification | Symbol to specify special specification product | |

Note: The part number is stamped on the top face of the relay case as in the following example:

(Example) Ordering part number: FTR-P2CN012W1
 Stamped part number: P2CN012W1

FTR-P2 SERIES

■ SPECIFICATIONS

| Item | | Specification | Remark | |
|---------|------------------------------------|--|---|--------------------------------------|
| Contact | Arrangement | 1 FormC x 2 in H-Bridge | | |
| | Material | Silver-Tin Oxide-Indium Oxide | | |
| | Voltage drop | 100 mV maximum | Measured at 2A, 12 VDC | |
| | Contact rating | DC 16V, 25A (motor locked) | | |
| | Maximum Carrying Current | 25 A/ 1 hour (25 C, nominal voltage applied to coil) | | |
| | Minimum Load* | 6V 1A | Reference value | |
| Coil | Operating Temperature Range | -40° C to +85° C | No frost | |
| | Storage Temperature Range | -40° C to +100° C | | |
| Time | Operate (at nominal voltage) | 10 ms maximum | When nominal coil voltage is applied to coil, or removed, no diode. | |
| | Release (at nominal voltage) | 5 ms maximum | | |
| Life | Mechanical | 10 million operations minimum | At contact rating | |
| | Electrical | 100K operations minimum | | |
| Other | Vibration resistance (Operational) | | = 9.13G@55Hz | |
| | Shock resistance | Operational | | 100 m/s ² minimum (10G) |
| | | No Damage | | 1000 m/s ² minimum (100G) |
| | Weight | Approximately 13 grams | | |
| | Average sound pressure | | A weighting | |
| | Approximately 50 dB at 5 cm | | | |

*This is the standard value of the minimum load level. This value may differ depending on the switching frequency, environmental conditions and target reliability standard. We recommend to check this value by an actual load prior to use.

■ COIL DATA

| Product Name | Nominal Coil Voltage | Coil Resistance* (±10%) | Power Consumption at nominal coil voltage* | Must Operate Voltage* | Must Release Voltage |
|---------------|----------------------|-------------------------|--|-----------------------|----------------------|
| FTR-P2CN009W1 | DC 9V | 180Ω | 450mW | 5.5V | 0.72 |
| FTR-P2CN010W1 | DC 10V | 220Ω | 455mW | 6.3V | 0.8 |
| FTR-P2CN012W1 | DC 12V | 320Ω | 450mW | 7.3V | 0.96 |

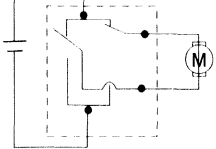
* At 20°C.

CHARACTERISTIC DATA

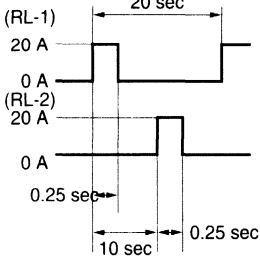
1. LIFE TEST (EXAMPLES)

- Test item
14 V DC-25 A
Motor Lock
100K operations
minimum

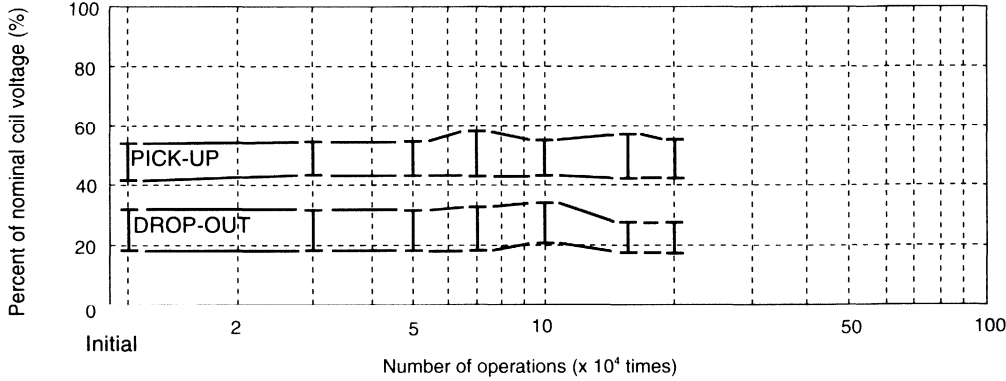
• Test circuit



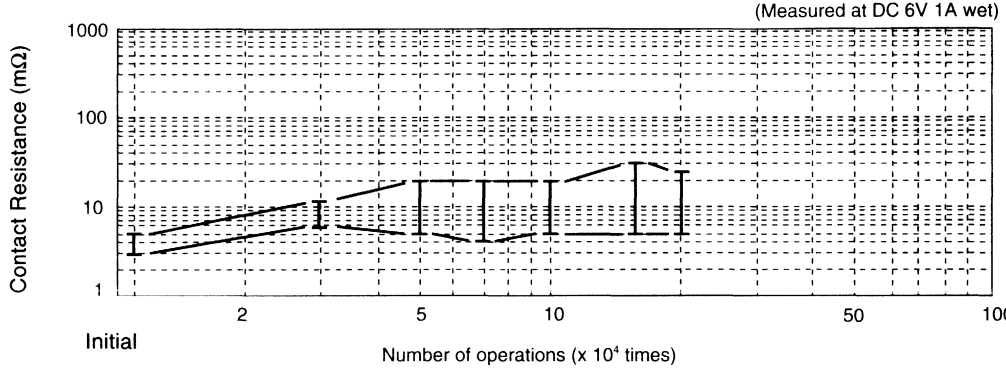
• Current wave form



• Shift of pick-up drop-out voltage

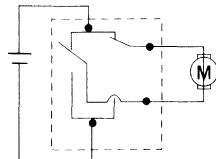


• Change in contact resistance



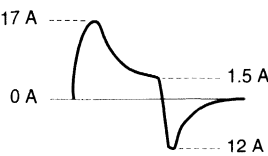
- Test item
14 V DC,
inrush current: 17A
motor free
300K operations minimum
0.25 seconds ON,
9.75 seconds OFF

• Test circuit

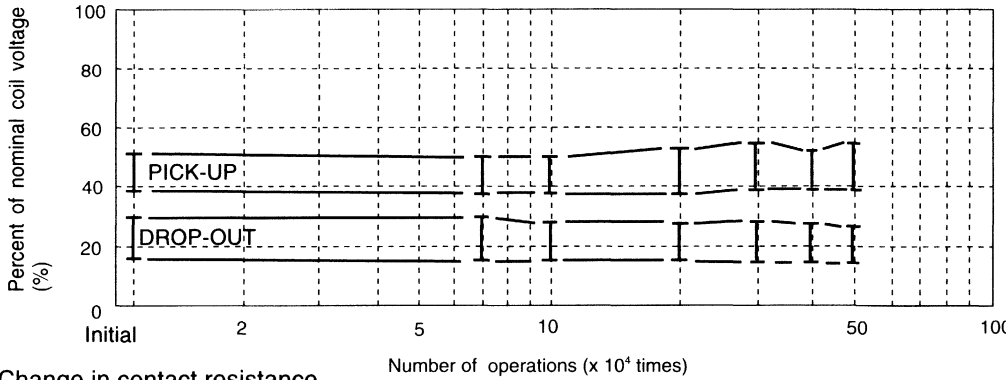


- Notes: 1. Test was done on one side of twin relay
2. NC contacts provide dynamic brake circuits

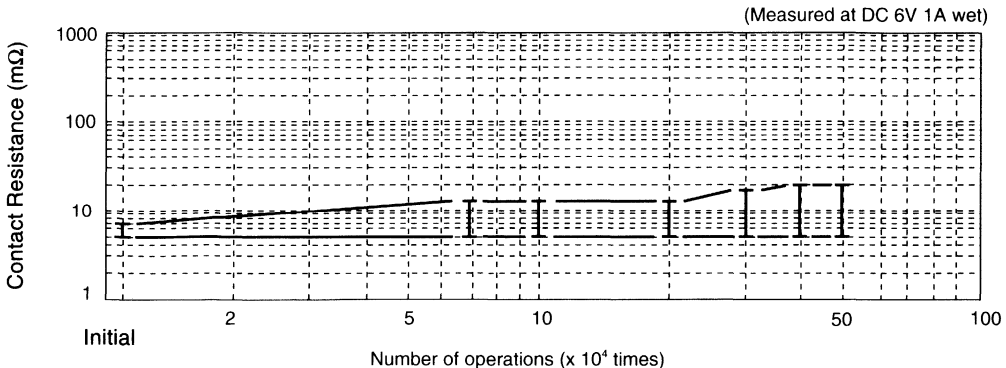
• Current wave form



• Change in pick-up drop-out voltage

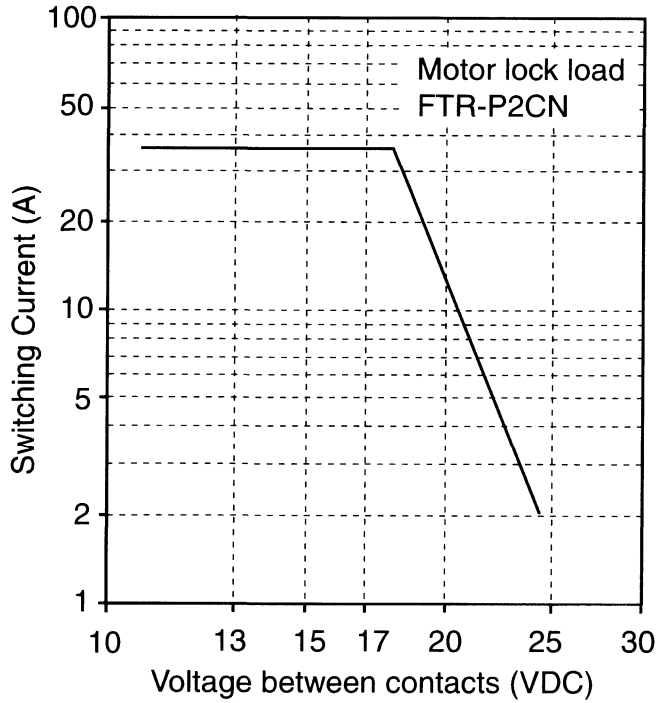


• Change in contact resistance

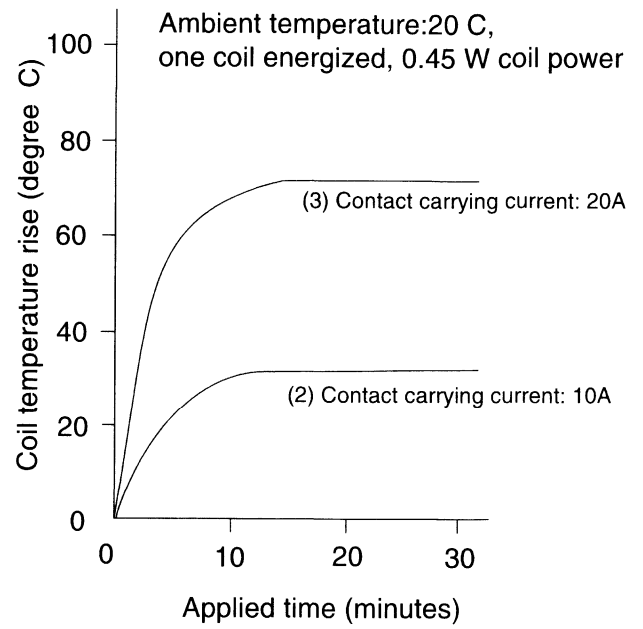


FTR-P2 SERIES

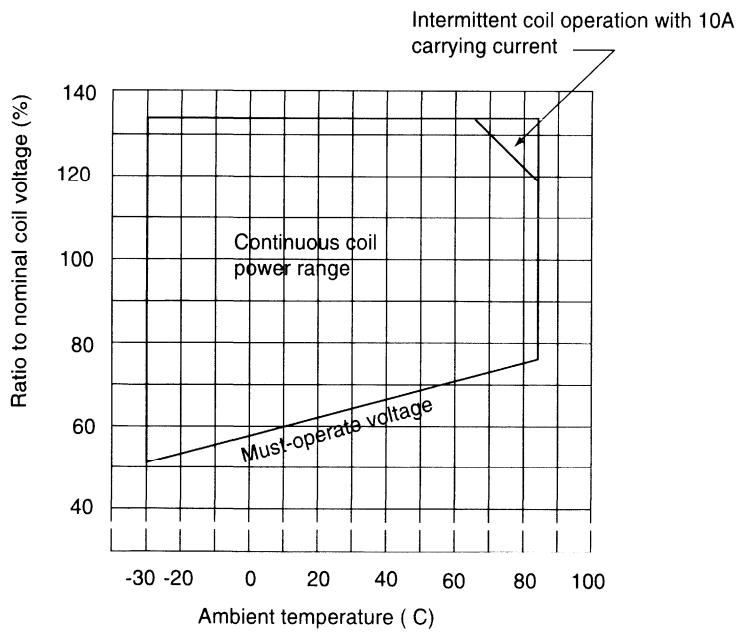
2. MAXIMUM BREAK CAPACITY



3. COIL TEMPERATURE RISE

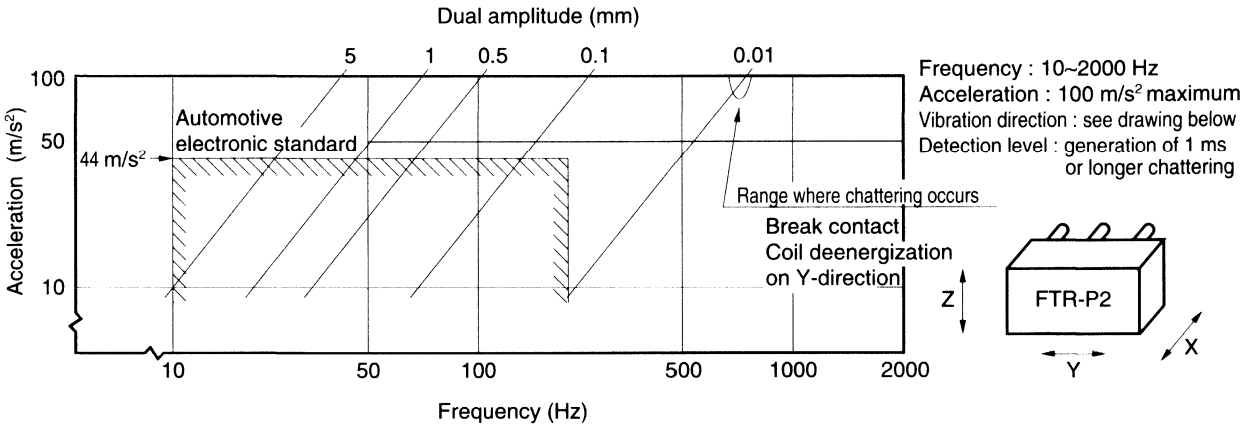


4. OPERATING COIL VOLTAGE RANGE

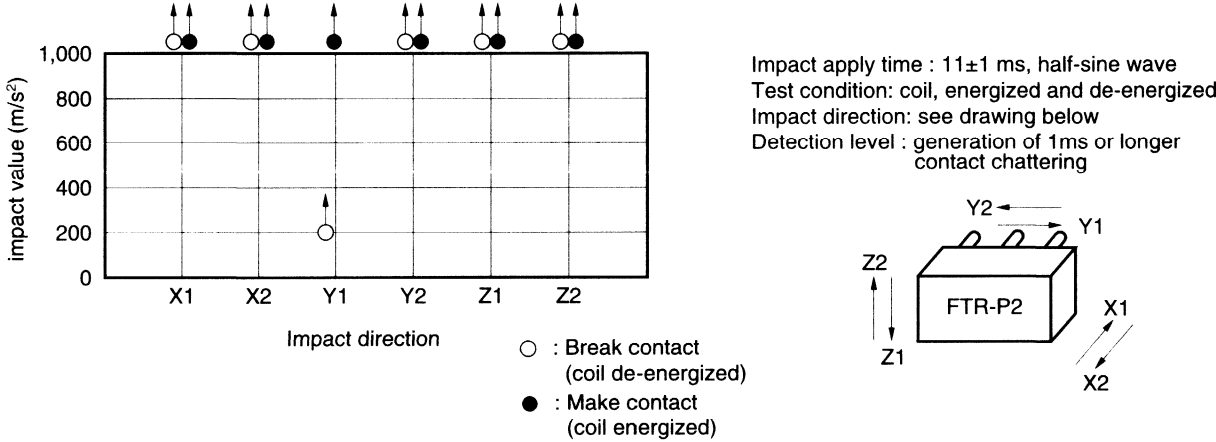


FTR-P2 SERIES

5. VIBRATION RESISTANCE CHARACTERISTICS

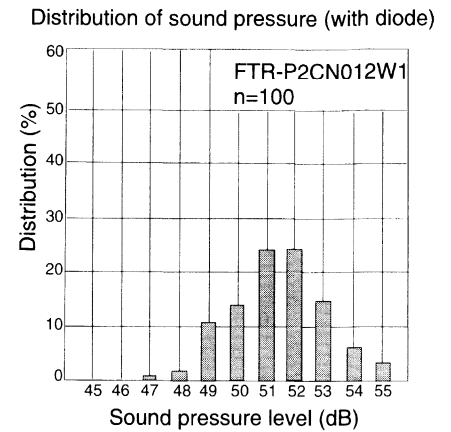
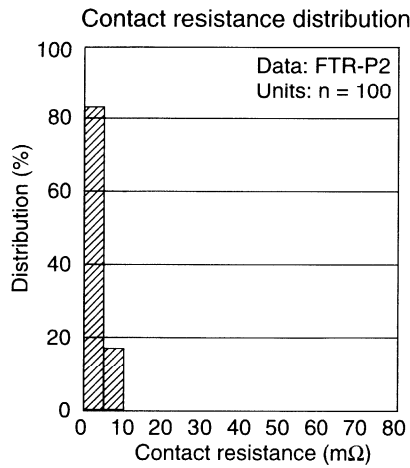
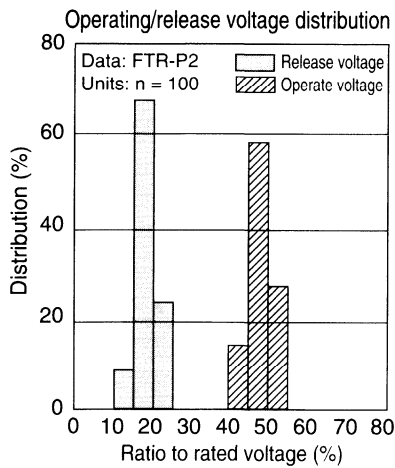


6. SHOCK RESISTANCE CHARACTERISTIC

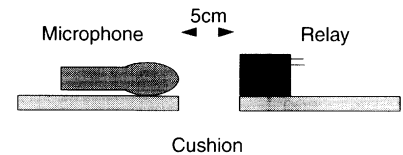


FTR-P2 SERIES

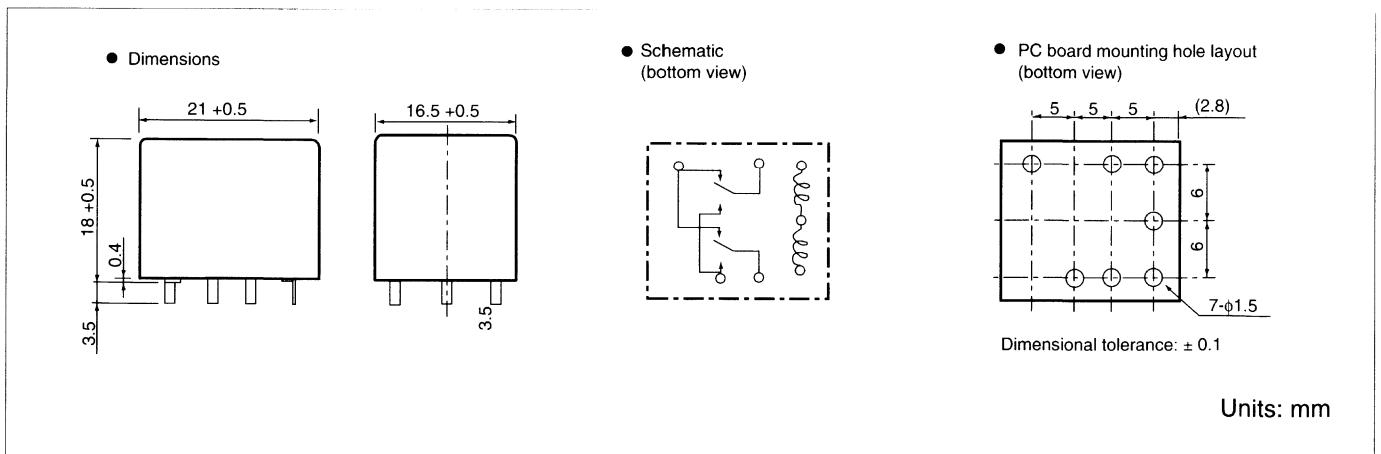
REFERENCE DATA



Method of acoustic noise measure
Measuring condition: Distance from 5 cm, relay operation at 10Hz
Tester: Noise tester Ryon NA-61, A range



DIMENSIONS



POWER RELAY

1 POLE—15 to 25 A (FOR AUTOMOTIVE APPLICATIONS)

FBR161,166 SERIES

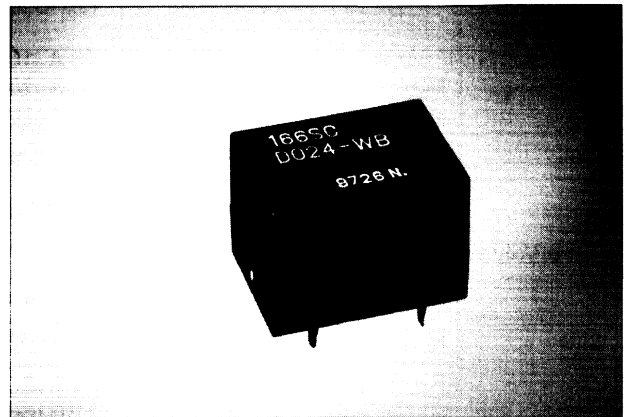
■ FEATURES

- Suitable for automotive applications such as motor load controls, door locks, power windows, wipers, etc.
- Variety of contact materials covering wide current switching in range of 15 A to 25 A (at 14 VDC)
- FBR166 series with high conductive spring and improved break performance is also available

■ ORDERING INFORMATION

● FBR161 Series

[Example] $\frac{\text{FBR161}}{\text{(a)}} \frac{\text{S}}{\text{(b)}} \frac{\text{E}}{\text{(c)}} \frac{\text{D012}}{\text{(d)}} - \frac{\text{W}}{\text{(e)}} \frac{\text{**}}{\text{(f)}} \frac{\text{**}}{\text{(g)}}$



| | | |
|-----|--------------------|---|
| (a) | Series Name | FBR161: 1 form C FBR161 Series |
| (b) | Enclosure | S : Flux free type N : Plastic sealed type |
| (c) | Coil Type | E : Nominal power 0.36 to 0.38 W C : Nominal power 0.45 to 0.5 W |
| (d) | Nominal Voltage | D012 : 12 VDC (example) |
| (e) | Contact Material | C : Silver copper (15 A maximum) W : Silver-tin oxide indium (20 A maximum) WB : Silver-tin oxide indium (25 A maximum) |
| (f) | Custom Designation | Custom specification to be assigned |
| (g) | Package Style | Nil : Standard tray -S : Tube carrier |

● FBR166 Series

[Example] $\frac{\text{FBR166}}{\text{(a)}} \frac{\text{S}}{\text{(b)}} \frac{\text{CD009}}{\text{(c)}} - \frac{\text{WB}}{\text{(d)}} \frac{\text{**}}{\text{(e)}} - \frac{\text{**}}{\text{(f)}}$

| | | |
|-----|--------------------|---|
| (a) | Series Name | FBR166: 1 form C FBR166 Series |
| (b) | Enclosure | S : Flux free type N : Plastic sealed type |
| (c) | Nominal Voltage | CD009 : 9 VDC (example) |
| (d) | Contact Material | WB : Silver-tin oxide indium (25 A maximum) |
| (e) | Custom Designation | Custom specification to be assigned |
| (f) | Package Style | Nil : Standard tray -S : Tube carrier |

FBR161,166 SERIES

■ SPECIFICATIONS

| Item | | Specifications | |
|------------|------------------------------|---|--|
| Contact | Arrangement | 1 Form C (SPDT) | |
| | Material | C : Silver copper (15 A maximum) W : Silver-tin oxide indium (20 A maximum) WB : Silver-tin oxide indium (25 A maximum) | |
| | Voltage Drop (resistance) | Maximum 100 mV (at 1 A 6 VDC) | |
| | Maximum Carrying Current | Contact C and W type: 17 A/1 hour, 5 A (continuously) Contact WB type : 25 A/1 hour, 10 A (continuously) (25°C, 100% rated coil voltage) | |
| | Maximum Switching Current | 15 A 16 VDC (silver copper: C type) 20 A 16 VDC (silver-tin oxide indium : W type) 25 A 16 VDC (silver-tin oxide indium: WB type) | |
| Coil | Operating Temperature | -40°C to +85°C (no frost) (refer to the CHARACTERISTIC DATA) | |
| | Storage Temperature | -40°C to +100°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | |
| | Electrical | FBR160 Series: 100 x 10 ³ operations minimum FBR166 Series: 200 x 10 ³ operations minimum (14 VDC, maximum switching current, resistive load) (refer to the CHARACTERISTIC DATA) | |
| Other | Vibration Resistance | | 10 to 55 Hz (double amplitude of 1.5 mm) |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ±1 ms) |
| | | Endurance | 1,000 m/s ² (11 ±1 ms) |
| Weight | | Approximately 11 g | |

■ COIL RATINGS

| MODEL | | Nominal voltage | Coil resistance voltage ±10% | Must operate voltage (+20°C) | Must operate voltage (+80°C) | Operating voltage (reference) | Nominal power | Contact material | Thermal resistance |
|---------------|------------------------|-----------------|------------------------------|------------------------------|------------------------------|-------------------------------|----------------|-------------------------|--------------------|
| FBR161 Series | FBR161S (N) ED009-W32 | 9 VDC* | 210Ω | 6.0 V | 7.4 V | 6.0 V to 14.0 V | Approx. 380 mW | Silver tin indium oxide | 84°C/W |
| | FBR161S (N) ED009-W12 | 9 VDC* | 225Ω | 6.5 V | 8.0 V | 6.5 V to 14.0 V | Approx. 360 mW | Silver tin indium oxide | 83°C/W |
| | FBR161S (N) ED009-WB38 | 9 VDC* | 225Ω | 6.5 V | 8.0 V | 6.5 V to 16.0 V | Approx. 360 mW | Silver tin indium oxide | |
| | FBR161S (N) CD012-C36 | 12 VDC | 320Ω | 7.3 V | 9.0 V | 7.3 V to 15.5 V | Approx. 450 mW | Silver copper | 78°C/W |
| | FBR161S (N) CD012-W36 | 12 VDC | 320Ω | 7.3 V | 9.0 V | 7.3 V to 15.0 V | Approx. 450 mW | Silver tin indium oxide | |
| | FBR161S (N) CD012-W31 | 12 VDC | 290Ω | 7.3 V | 9.0 V | 7.3 V to 15.5 V | Approx. 500 mW | Silver tin indium oxide | 76°C/W |
| FBR166 Series | FBR166S (N) CD009-WB | 9 VDC* | 120Ω | 6.3 V | 7.8 V | 6.3 V to 14.0 V | Approx. 670 mW | Silver tin indium oxide | 67°C/W |
| | FBR166S (N) CD012-WB | 12 VDC | 210Ω | 7.3 V | 9.0 V | 7.3 V to 14.0 V | Approx. 680 mW | Silver tin indium oxide | |

* For typical 12 VDC automotive applications.

FBR161,166 SERIES

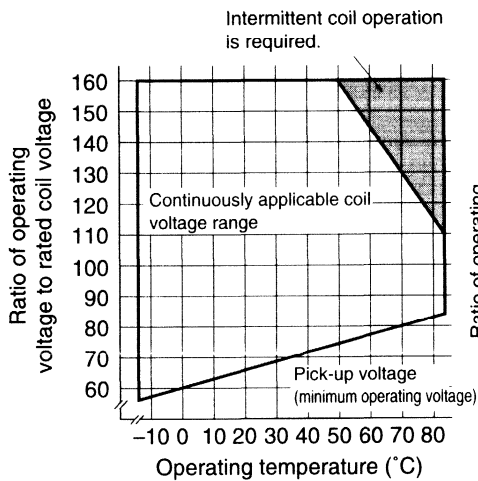
CHARACTERISTIC DATA

1. SERVICE LIFE WITH ACTUAL MOTOR LOAD TEST (example)

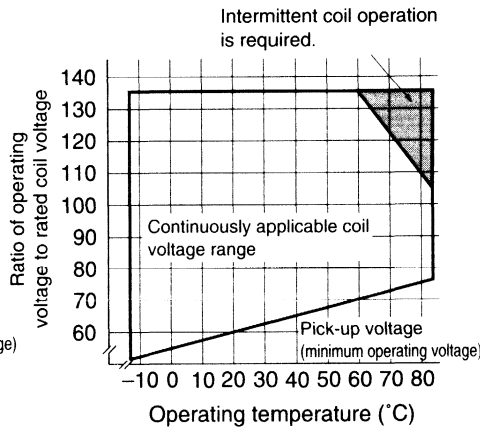
- Wiper motor (free, 16 VDC inrush 20 A, break 2 A) : more than 300×10^3 operations (FBR160-W, silver tin oxide alloy)
- Wiper motor (free, 14 VDC inrush 25 A, break 5 A) : more than 500×10^3 operations (FBR160-WB, silver tin oxide alloy)
- Door lock motor (stall, 14 VDC inrush -25 A) : more than 100×10^3 operations (FBR160-W, silver tin oxide alloy)
- Door lock motor (stall, 14 VDC inrush -25 A) : more than 200×10^3 operations (FBR166)

2. OPERATING COIL VOLTAGE (example)

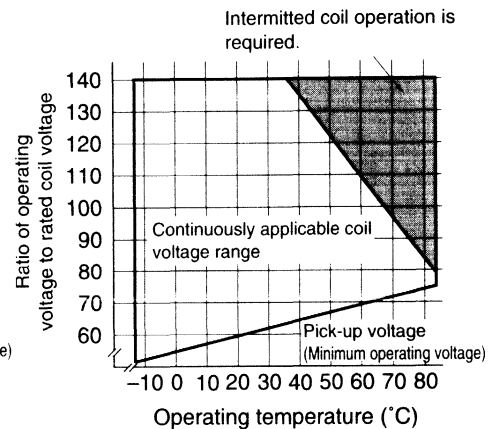
[FBR161S(N)ED009-W32,
approximately 380 mW type]



[FBR161SCD012-W36,
Approximately 450 mW type]

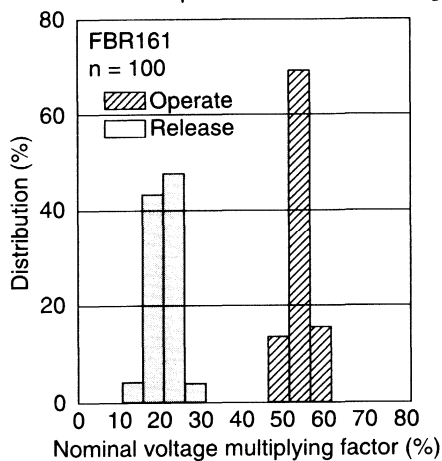


[FBR166S (N) CD012-WB,
approximately 680 mW type]

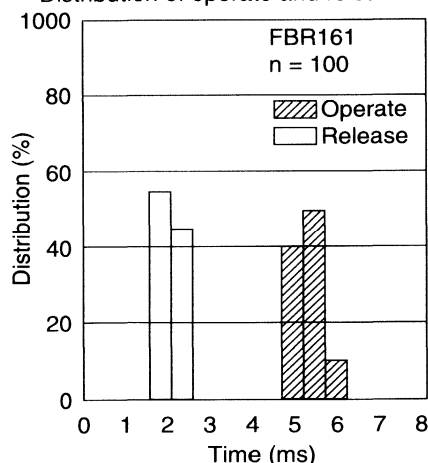


REFERENCE DATA

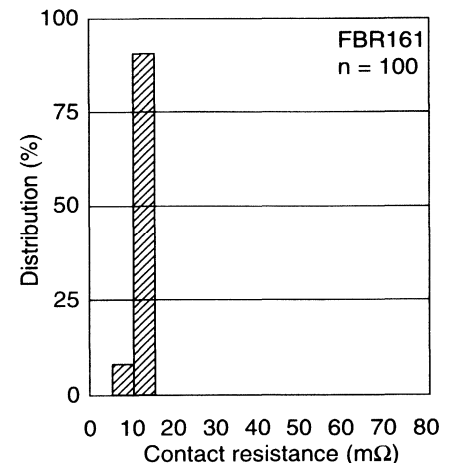
Distribution of operate and release voltage



Distribution of operate and release time



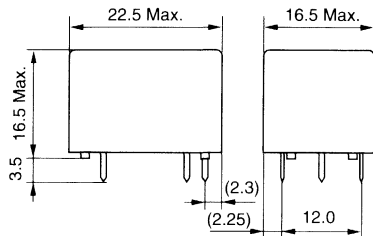
Distribution of contact resistance



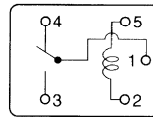
FBR161,166 SERIES

■ DIMENSIONS

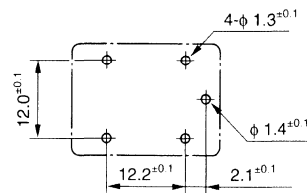
● Dimensions



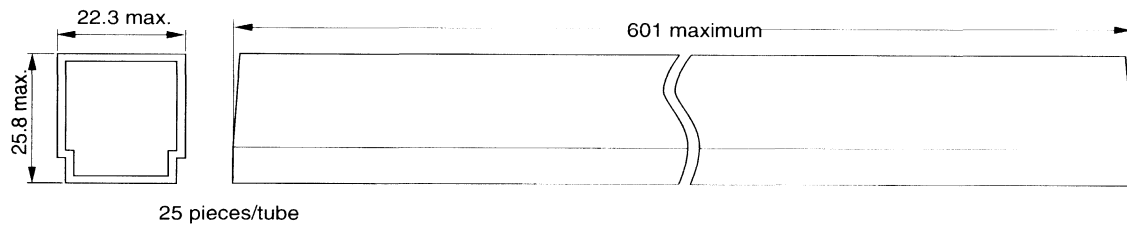
● Schematic (BOTTOM VIEW)



● PC board mounting hole layout (BOTTOM VIEW)



● Tube carrier



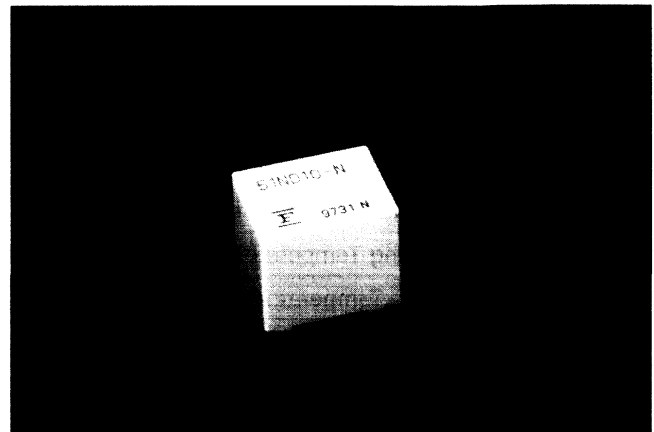
COMPACT POWER RELAY

1 POLE—25 A (FOR AUTOMOTIVE APPLICATIONS)

FBR51, 52 SERIES

■ FEATURES

- Compact and lightweight structure
(42% of the volume of the FBR160 relay)
- High current contact capacity
(carrying current: 35 A/10 minutes, 25 A/1 hour)
- High resistance to vibration and shock
- Improved heat resistance and extended operation range
- Two contact gap options
(FBR51: 0.3 mm, FBR52: 0.6 mm)
- Three types of contact material



■ ORDERING INFORMATION

[Example] FBR51 N D12 - W **
 (a) (b) (c) (d) (e)

| | | |
|-----|--------------------|---|
| (a) | Series Name | FBR51 : Standard type (contact gap 0.3 mm) FBR52 : Wider contact gap type (contact gap 0.6 mm) |
| (b) | Enclosure | N : Plastic sealed type |
| (c) | Nominal Voltage | D06 : 6 VDC D09 : 9 VDC D10 : 10 VDC D12 : 12 VDC |
| (d) | Contact Material | W : Silver-tin oxide indium W1 : Silver-tin oxide indium (high power type) N : Silver copper nickel |
| (e) | Custom Designation | To be assigned custom specification |

FBR51, 52 SERIES

■ SPECIFICATIONS

| Item | | Specifications | | |
|------------|------------------------------------|---|---|--|
| | | W contact | W1 contact | N contact |
| Contact | Arrangement | 1 form C (SPDT) | | |
| | Material | Silver-tin oxide indium | Silver-tin oxide indium (high power type) | Silver copper nickel |
| | Voltage Drop (Resistance) | Maximum 100 mV (at 2 A 12 VDC) | | |
| | Rating | 14 VDC 20 A (motor free load) | 14 VDC 25 A (motor free load) | 14 VDC inrush 20 A, break 4 A (motor free load) |
| | Maximum Carrying Current | 35 A/10 minutes, 25 A/ 1 hour (25°C, 100% rated coil voltage) | | |
| | Maximum Inrush Current (Reference) | 60 A | | 40 A |
| | Max. Switching Current (Reference) | 35 A 16 VDC | | |
| | Min. Switching Load*1 (Reference) | 6 VDC 1 A | | |
| Coil | Operating Temperature Range | -40°C to + 85°C (no frost) | | |
| | Storage Temperature Range | -40°C to +100°C (no frost) | | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | | |
| | Release (at nominal voltage) | Maximum 5 ms | | |
| Life | Mechanical | 10 x10 ⁶ operations minimum | | |
| | Electrical | 200x10 ³ ops.minimum (14 VDC 20 A locked motor load) | 200x10 ³ ops.minimum (14 VDC 25 A locked motor load) | 400 x10 ³ ops.minimum (14 VDC inrush 20 A break 4 A motor free load) |
| Other | Vibration Resistance | 10 to 55 Hz (double amplitude of 1.5 mm) | | |
| | Shock Resistance | Misoperation | 100 m/s ² | |
| | | Endurance | 1,000 m/s ² | |
| | Weight | Approximately 6 g | | |

*1 Values when switching a resistive load at normal room temperature and humidity and in a clean environment. The minimum switching load varies with the switching frequency and operating environment.

FBR51, 52 SERIES

■ COIL DATA CHART

1. FBR51 Series

| MODEL | | | Nominal voltage | Coil resistance (±10%) (at 20°C) | Must operate voltage | Thermal resistance |
|-------------|--------------|-------------|-----------------|-------------------------------------|--|--------------------|
| W contact | W1 contact | N contact | | | | |
| FBR51ND06-W | FBR51ND06-W1 | FBR51ND06-N | 6 VDC | 60Ω | 3.6 VDC (at 20°C) 4.5 VDC (at 85°C) | 73°C/W |
| FBR51ND09-W | FBR51ND09-W1 | FBR51ND09-N | 9 VDC | 135Ω | 5.4 VDC (at 20°C) 6.8 VDC (at 85°C) | |
| FBR51ND10-W | FBR51ND10-W1 | FBR51ND10-N | 10 VDC | 180Ω | 6.3 VDC (at 20°C) 7.9 VDC (at 85°C) | |
| FBR51ND12-W | FBR51ND12-W1 | FBR51ND12-N | 12 VDC | 240Ω | 7.3 VDC (at 20°C) 9.0 VDC (at 85°C) | |

2. FBR52 Series

| MODEL | | | Nominal voltage | Coil resistance (±10%) (at 20°C) | Must operate voltage | Thermal resistance |
|-------------|--------------|-------------|-----------------|-------------------------------------|--|--------------------|
| W contact | W1 contact | N contact | | | | |
| FBR52ND06-W | FBR52ND06-W1 | FBR52ND06-N | 6 VDC | 45Ω | 3.6 VDC (at 20°C) 4.5 VDC (at 85°C) | 65°C/W |
| FBR52ND09-W | FBR52ND09-W1 | FBR52ND09-N | 9 VDC | 100Ω | 5.4 VDC (at 20°C) 6.8 VDC (at 85°C) | |
| FBR52ND10-W | FBR52ND10-W1 | FBR52ND10-N | 10 VDC | 135Ω | 6.3 VDC (at 20°C) 7.9 VDC (at 85°C) | |
| FBR52ND12-W | FBR52ND12-W1 | FBR52ND12-N | 12 VDC | 180Ω | 7.3 VDC (at 20°C) 9.0 VDC (at 85°C) | |

FBR51, 52 SERIES

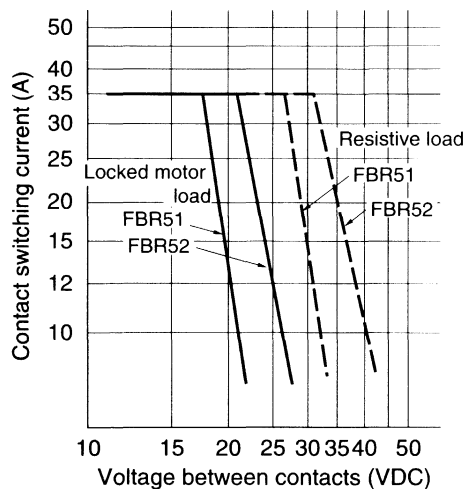
■ SUITABLE APPLICATIONS

| Application | Normal load current (12 VDC system) | Description | Recommended model (example) | |
|------------------------|---|--------------------------------------|--|--|
| | | | For 16 V or less motor load voltage | For instantaneous 20 V or more load voltage |
| Power Windows | 20 to 25 A (switching at motor locking) | forward and reverse motor control | FBR51N □ -W FBR51N □ -W1 | FBR52N □ -W FBR52N □ -W1 |
| Automatic Door Lock | 18 to 25 A (switching at motor locking) | forward and reverse motor control | FBR51N □ -W FBR51N □ -W1 | FBR52N □ -W FBR52N □ -W1 |
| Intermittent Wipers | 15 to 30 A break 2 to 8 A (motor-free) | forward only | FBR51N □ -N | FBR52N □ -N |
| Tilt-Lock Wheel | 20 A (switching at motor locking) | forward and reverse motor control | FBR51N □ -W | FBR52N □ -W |
| Sunroof | 20 to 30 A (switching at motor locking) | forward and reverse motor control | FBR51N □ -W | FBR52N □ -W |
| Adjustable Door Mirror | 3 to 5 A (switching at motor locking) | forward and reverse motor control | FBR51N □ -W | |
| Automatic Antenna | 8 to 12 A (INRUSH) break 2 A maximum (motor-free) | forward and reverse motor control | FBR51N □ -W | |
| Auto-Cruise | 2 to 3 A | power shutoff and solenoid | FBR51N □ -W | |
| Others | Car Audio System, etc. | | FBR51N □ -W | |

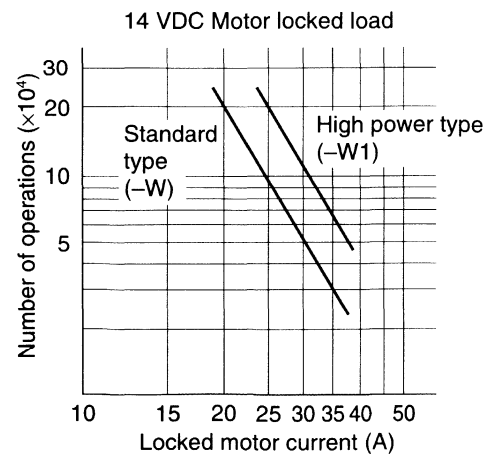
- For the load condition where higher voltage would be encountered during contact break, FBR52 series with wider contact gap is recommended.
- -N contact type is recommended for applications which require long durability, -W and -W1 contact type is for high inrush current load applications.

■ CHARACTERISTIC DATA

1. MAXIMUM BREAK CAPACITY



2. LIFE

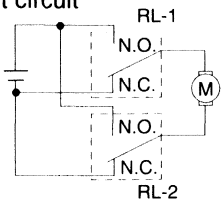


FBR51, 52 SERIES

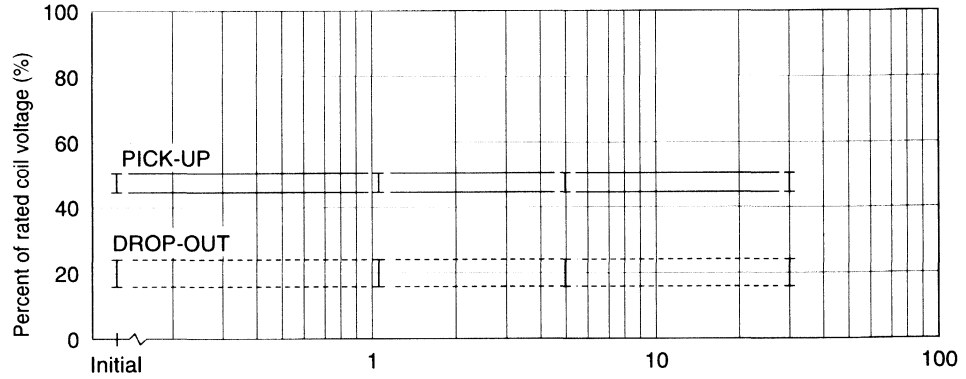
3. LIFE TEST (EXAMPLE)

- Test item
14 V DC-20 A
motor lock 200,000
operations minimum
(FBR52 -W type)

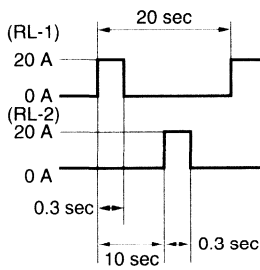
- Test circuit



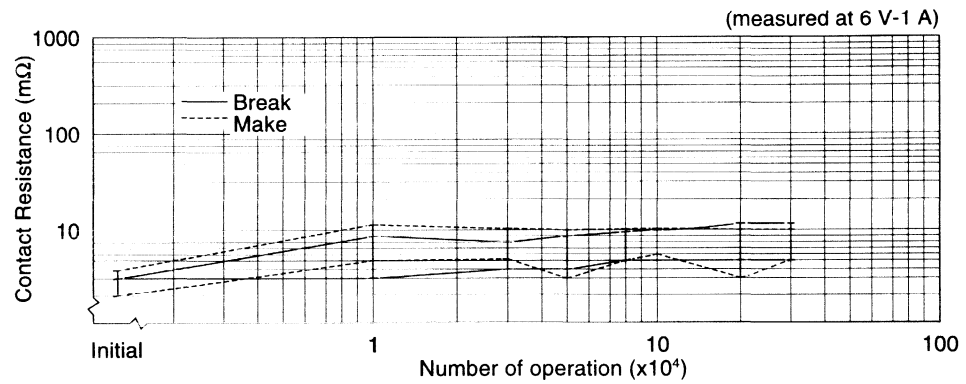
- Shift of pick-up drop-out voltage



- Current wave form

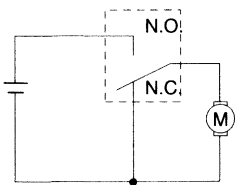


- Shift of contact resistance

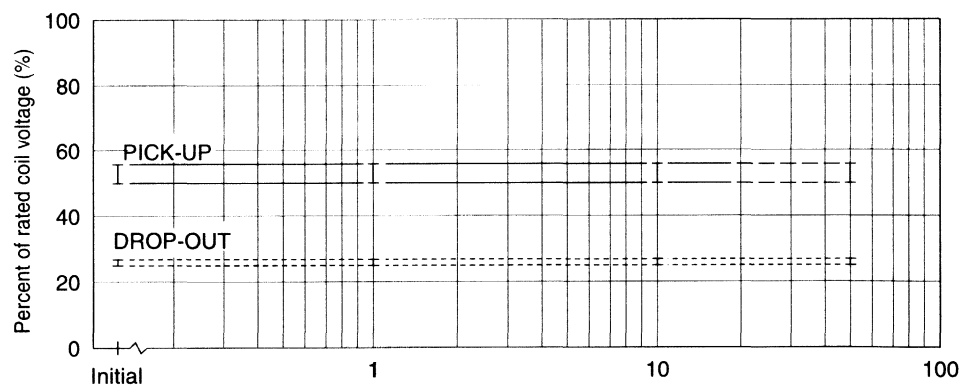


- Test item
14 V DC-20 A
motor free 400,000
operations minimum
(FBR51 -N type)

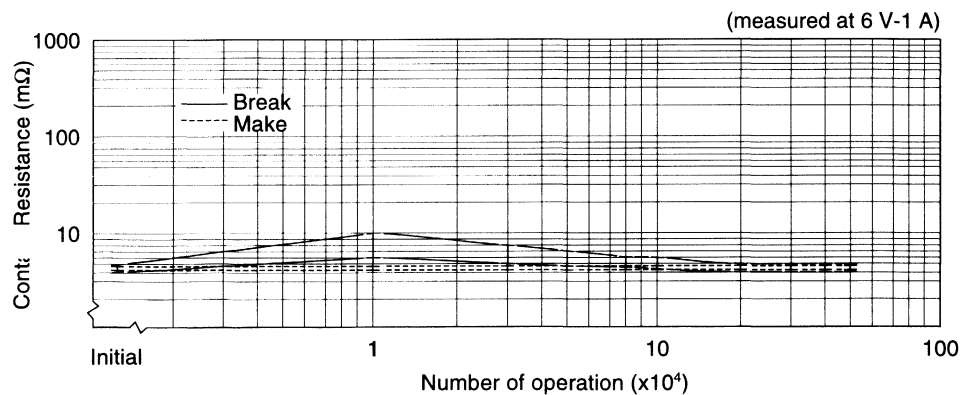
- Test circuit



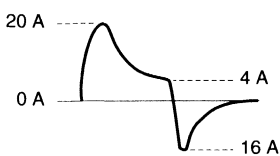
- Shift of pick-up drop-out voltage



- Shift of contact resistance



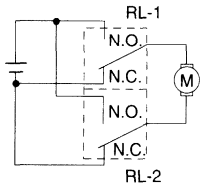
- Current wave form



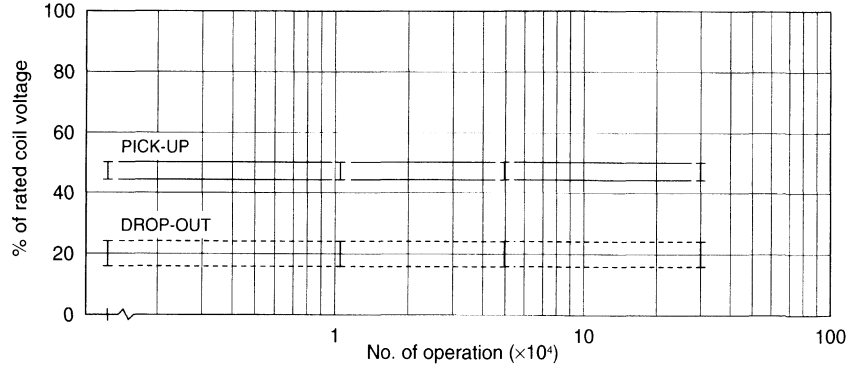
FBR51, 52 SERIES

- Test item
14 V DC-25 A
Motor lock
200,000 operations minimum
(FBR51 □-W1 type)

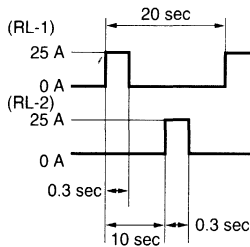
- Test circuit



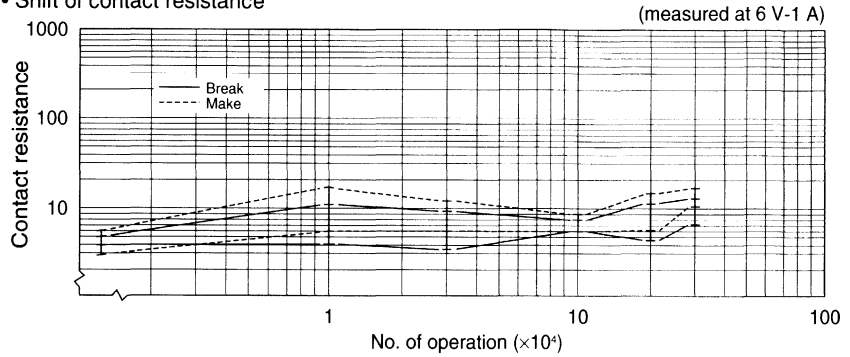
- Shift of pick-up and drop-out voltage



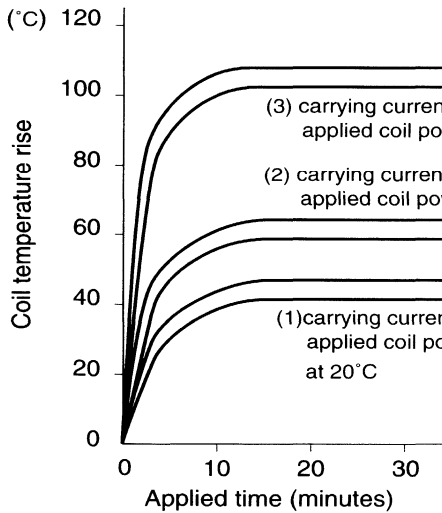
- Current wave form



- Shift of contact resistance



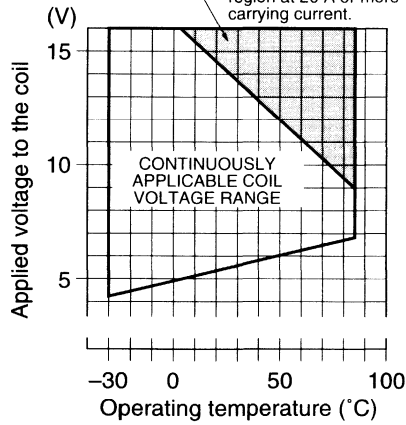
4. COIL TEMPERATURE RISE



5. OPERATING COIL VOLTAGE RANGE (EXAMPLE)

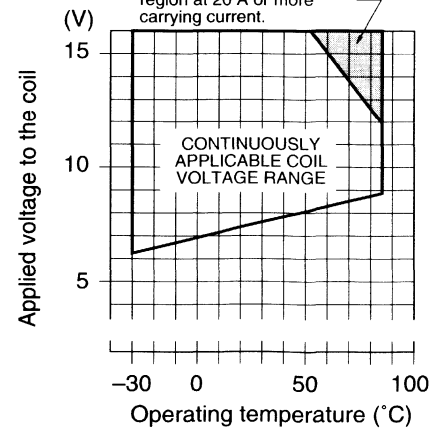
[FBR51ND09-□]

NOTE : Intermittent coil operation is required in this region at 20 A or more carrying current.



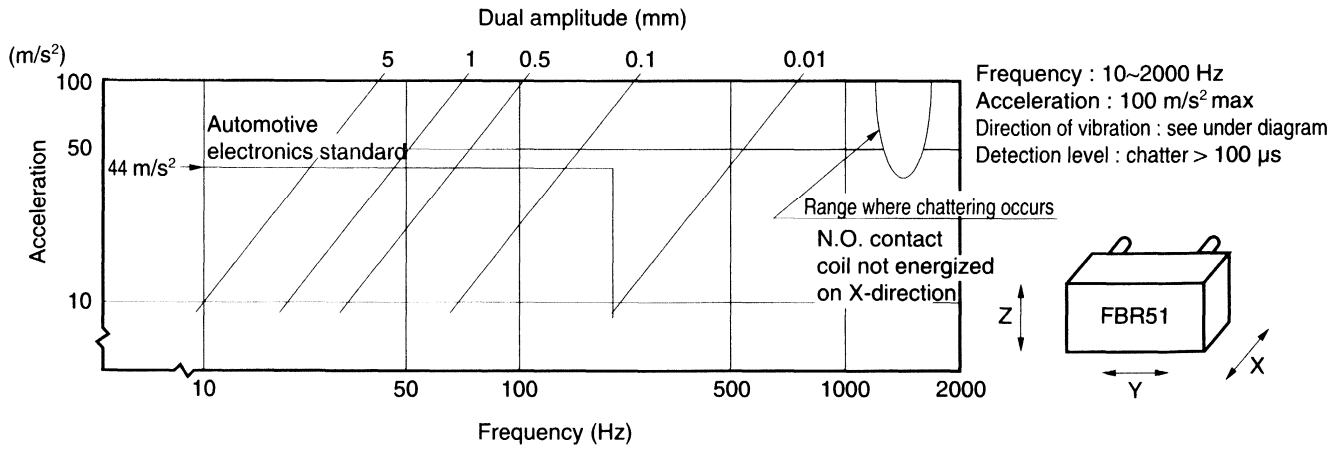
[FBR51ND12-□]

NOTE : Intermittent coil operation is required in this region at 20 A or more carrying current.

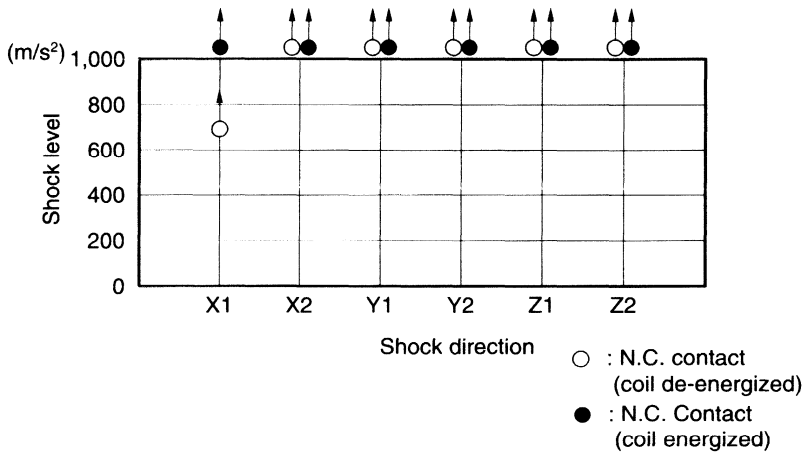


FBR51, 52 SERIES

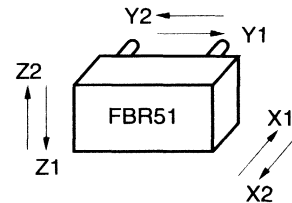
6. VIBRATION RESISTANCE CHARACTERISTICS



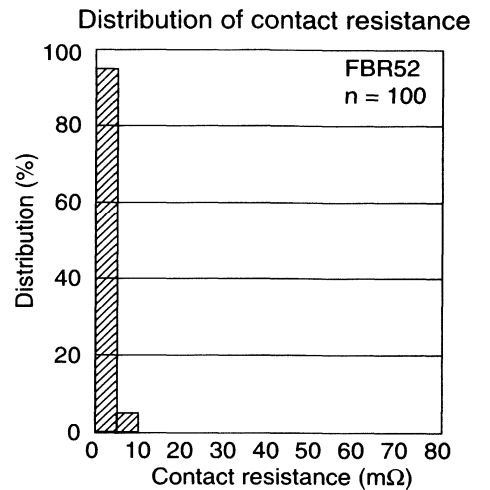
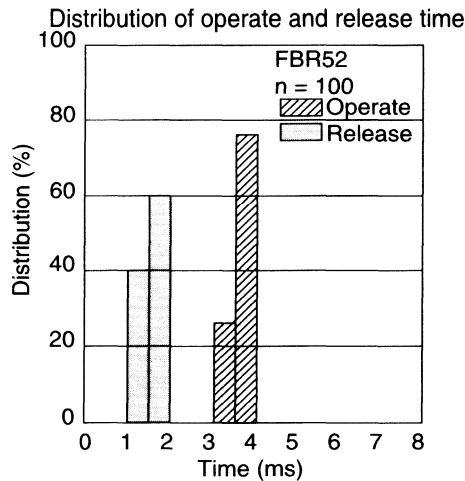
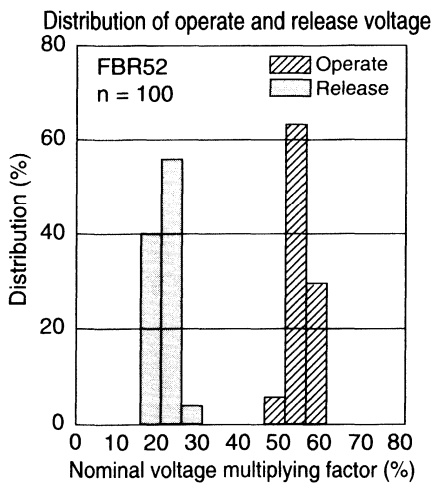
7. SHOCK RESISTANCE CHARACTERISTICS



Shock application time : 11 ms, half-sine wave
 Test material : coil, energized and de-energized
 Shock direction : set under diagram
 Detection level : chatter > 100 µs



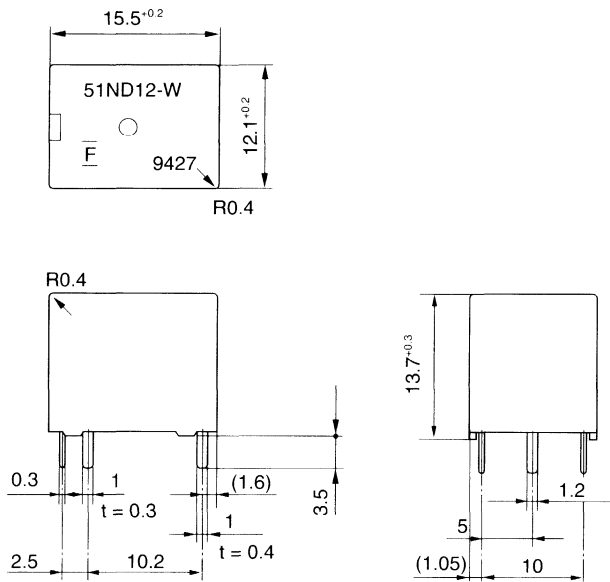
REFERENCE DATA



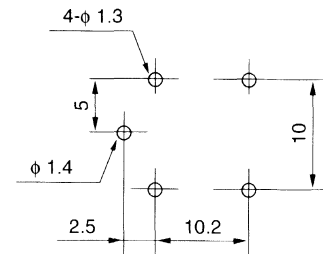
FBR51, 52 SERIES

■ DIMENSIONS

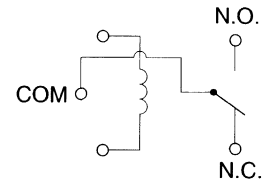
● Dimensions



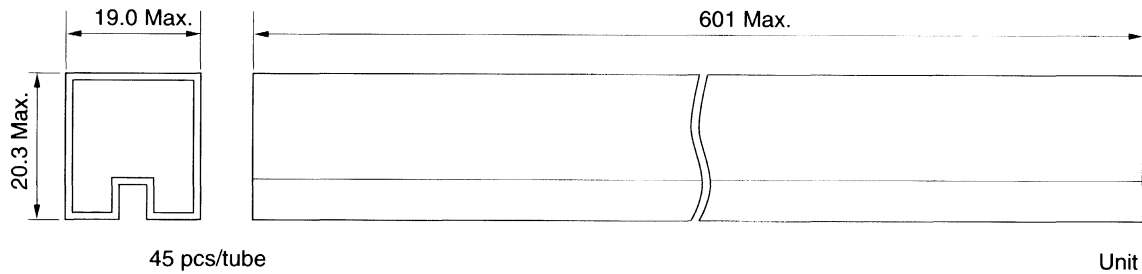
● PC board mounting hole layout (BOTTOM VIEW)



● Schemati (BOTTOM VIEW)



● Tube carrier



Unit : mm

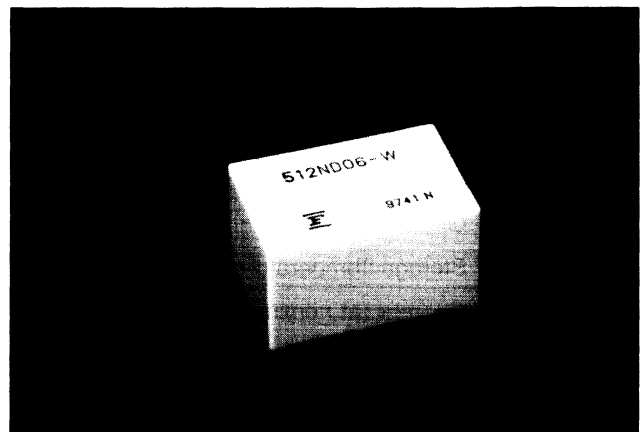
COMPACT POWER TWIN RELAY

1 POLE x 2—25 A (FOR AUTOMOTIVE APPLICATIONS)

FBR512, 522 SERIES

■ FEATURES

- Two independent relays mounted in a single package
- Miniature size
(54% of the volume of the FBR160 relays)
- High current contact capacity
(carrying current: 35 A/10 minutes, 25 A/1 hour)
- High resistance to vibration and shock
- Improved heat resistance and extended operating range
- Two contact gap options
(FBR510: 0.3 mm, FBR520: 0.6 mm)
- Two types of contact materials



■ ORDERING INFORMATION

[Example] FBR512 N D12 - W **
 (a) (b) (c) (d) (e)

| | | |
|-----|--------------------|---|
| (a) | Series Name | FBR512: Standard type (contact gap 0.3 mm) FBR522: Wider contact gap type (contact gap 0.6 mm) |
| (b) | Enclosure | N : Plastic sealed type |
| (c) | Nominal Voltage | D06 : 6 VDC D09 : 9 VDC D10 : 10 VDC D12 : 12 VDC |
| (d) | Contact Material | W : Silver-tin oxide indium W1 : Silver-tin oxide indium (high power type) |
| (e) | Custom Designation | To be assigned custom specification |

FBR512, 522 SERIES

■ SPECIFICATIONS

| Item | | Specifications | |
|------------|------------------------------------|---|---|
| | | W contact | W1 contact |
| Contact | Arrangement | 1 form C x 2 (SPDT x 2) | |
| | Material | Silver-tin oxide indium | Silver-tin oxide indium (high power type) |
| | Voltage Drop (Resistance) | Maximum 100 mV (at 2 A 12 VDC) | |
| | Rating | 14 VDC 20 A (locked motor load) | 14 VDC 25 A (locked motor load) |
| | Maximum Carrying Current | 35 A/10 minutes, 25 A/1 hour (25°C, 100% rated coil voltage) | |
| | Max. Inrush Current (Reference) | 60 A | |
| | Max. Switching Current (Reference) | 35 A 16 VDC | |
| | Min. Switching Load*1 (Reference) | 1 A 6 VDC | |
| Coil | Operating Temperature | -40°C to + 85°C (no frost) | |
| | Storage Temperature | -40°C to +100°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | |
| | Electrical | 200 x 10 ³ operations minimum (14 VDC 20 A locked motor load) | 200 x 10 ³ operations minimum (14 VDC 25 A locked motor load) |
| Other | Vibration Resistance | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | Shock Resistance | Misoperation | 100 m/s ² |
| | | Endurance | 1,000 m/s ² |
| | Weight | Approximately 13 g | |

*1 Values when switching a resistive load at normal room temperature and humidity, and in a clean environment. The minimum switching load varies with the switching frequency and operating environment.

■ COIL DATA CHART

1. FBR512 SERIES

| MODEL | | Nominal voltage | Coil resistance (±10%) (at 20°C) | Must operate voltage | Thermal resistance |
|--------------|---------------|-----------------|----------------------------------|--|--------------------|
| W contact | W1 contact | | | | |
| FBR512ND06-W | FBR512ND06-W1 | 6 VDC | 60Ω | 3.6 VDC (at 20°C) 4.5 VDC (at 85°C) | 73°C/W |
| FBR512ND09-W | FBR512ND09-W1 | 9 VDC | 135Ω | 5.4 VDC (at 20°C) 6.8 VDC (at 85°C) | |
| FBR512ND10-W | FBR512ND10-W1 | 10 VDC | 180Ω | 6.3 VDC (at 20°C) 7.9 VDC (at 85°C) | |
| FBR512ND12-W | FBR512ND12-W1 | 12 VDC | 240Ω | 7.3 VDC (at 20°C) 9.0 VDC (at 85°C) | |

FBR512, 522 SERIES

2. FBR522 SERIES

| MODEL | | Nominal voltage | Coil resistance (±10%) (at 20°C) | Must operate voltage | Thermal resistance |
|--------------|---------------|-----------------|-------------------------------------|--|--------------------|
| W contact | W1 contact | | | | |
| FBR522ND06-W | FBR522ND06-W1 | 6 VDC | 45Ω | 3.6 VDC (at 20°C) 4.5 VDC (at 85°C) | 65°C/W |
| FBR522ND09-W | FBR522ND09-W1 | 9 VDC | 100Ω | 5.4 VDC (at 20°C) 6.8 VDC (at 85°C) | |
| FBR522ND10-W | FBR522ND10-W1 | 10 VDC | 135Ω | 6.3 VDC (at 20°C) 7.9 VDC (at 85°C) | |
| FBR522ND12-W | FBR522ND12-W1 | 12 VDC | 180Ω | 7.3 VDC (at 20°C) 9.0 VDC (at 85°C) | |

■ SUITABLE APPLICATIONS

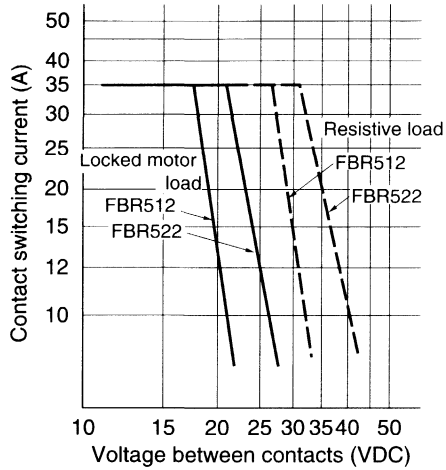
| Application | Normal load current (12 VDC system) | Description | Recommended model (example) | |
|---|---|--------------------------------------|--|--|
| | | | For 16 V or less motor load voltage | For instantaneous 20 V or more load voltage |
| Power Windows | 20 to 25 A (switching at motor locking) | forward and reverse motor control | FBR512N□ -W FBR512N□ -W1 | FBR522N□ -W FBR522N□ -W1 |
| Automatic Door Lock | 18 to 25 A (switching at motor locking) | forward and reverse motor control | FBR512N□ -W FBR512N□ -W1 | FBR522N□ -W FBR522N□ -W1 |
| Automatic Antenna | 8 to 12 A (INRUSH) break 2 A maximum (motor-free) | forward and reverse motor control | FBR512N□ -W FBR512N□ -W1 | |
| Intermittent Wipers (Front and Rear) | 15 to 30 A break 2 to 8 A (motor-free) | forward only | FBR512N□ -W FBR512N□ -W1 | FBR522N□ -W FBR522N□ -W1 |
| Tilt-Lock Wheel | 20 A (switching at motor locking) | forward and reverse motor control | FBR512N□ -W FBR512N□ -W1 | FBR522N□ -W FBR522N□ -W1 |
| Power Seat | 20 to 30 A (switching at motor locking) | forward and reverse motor control | FBR512N□ -W FBR512N□ -W1 | FBR522N□ -W FBR522N□ -W1 |
| Sunroof | 20 to 30 A (switching at motor locking) | forward and reverse motor control | FBR512N□ -W FBR512N□ -W1 | FBR522N□ -W FBR522N□ -W1 |

- For the load condition where higher voltage would be encountered during contact break, FBR522 series with wider contact gap is recommended.

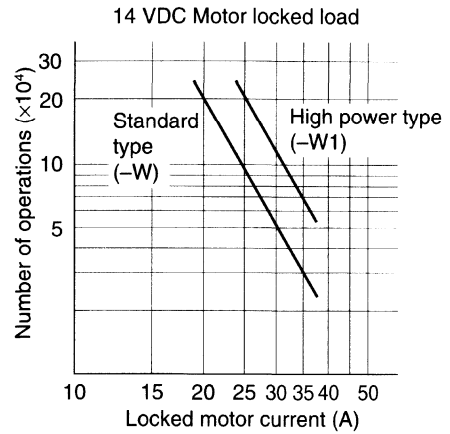
FBR512, 522 SERIES

CHARACTERISTIC DATA

1. MAXIMUM BREAK CAPACITY



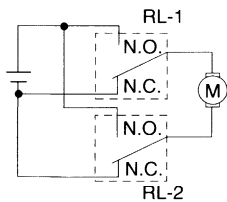
2. LIFE



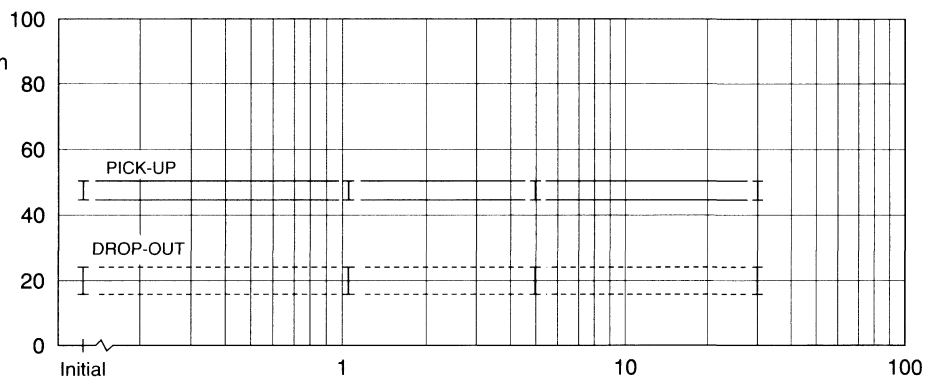
3. LIFE TEST (EXAMPLE)

- Test item
14 V DC-20 A
Motor lock
200,000 operations minimum
(FBR512 □-W type)

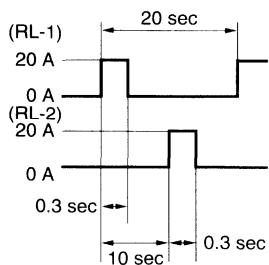
- Test circuit



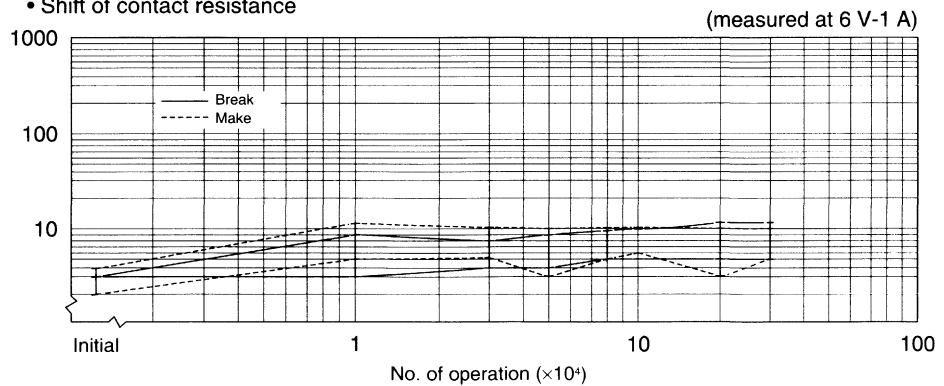
- Shift of pick-up and drop-out voltage



- Current wave form

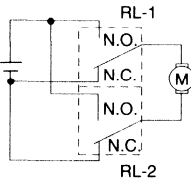


- Shift of contact resistance

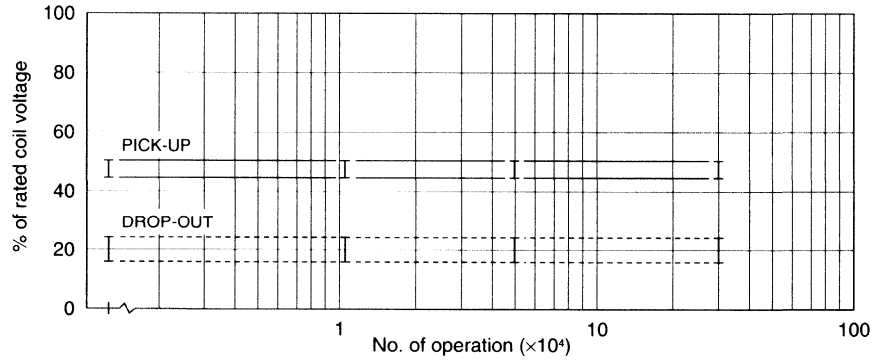


FBR512, 522 SERIES

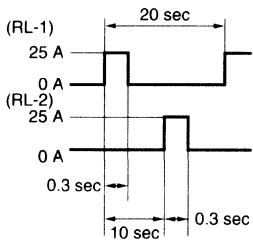
- Test item
14 V DC-25 A
Motor lock
200,000 operations minimum
(FBR512 □-W1 type)
- Test circuit



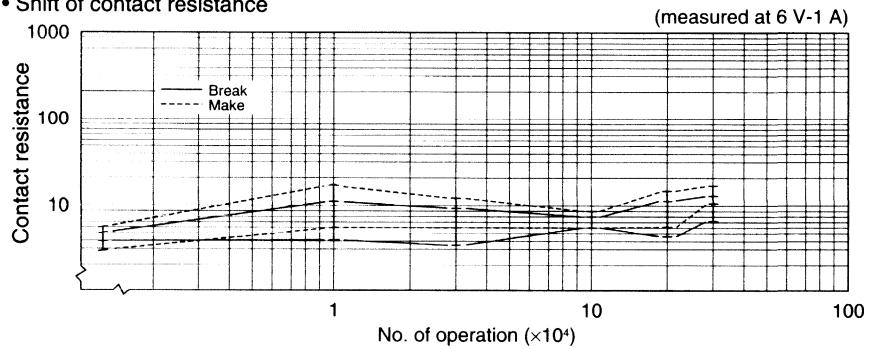
- Shift of pick-up and drop-out voltage



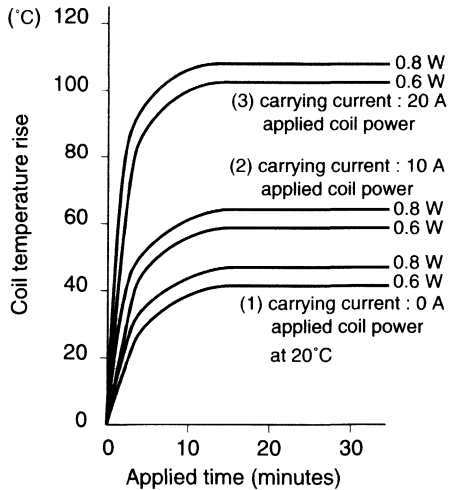
- Current wave form



- Shift of contact resistance



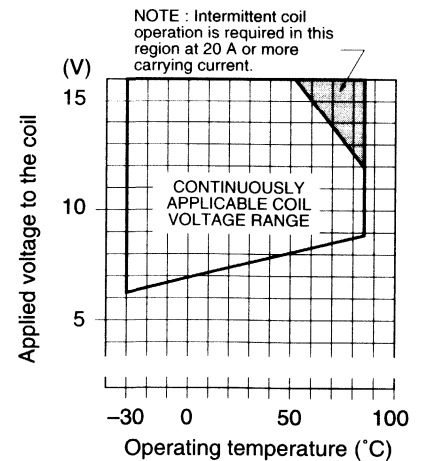
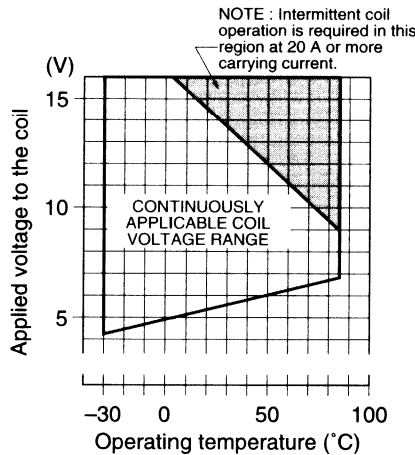
4. COIL TEMPERATURE RISE



5. OPERATING COIL VOLTAGE RANGE (EXAMPLE)

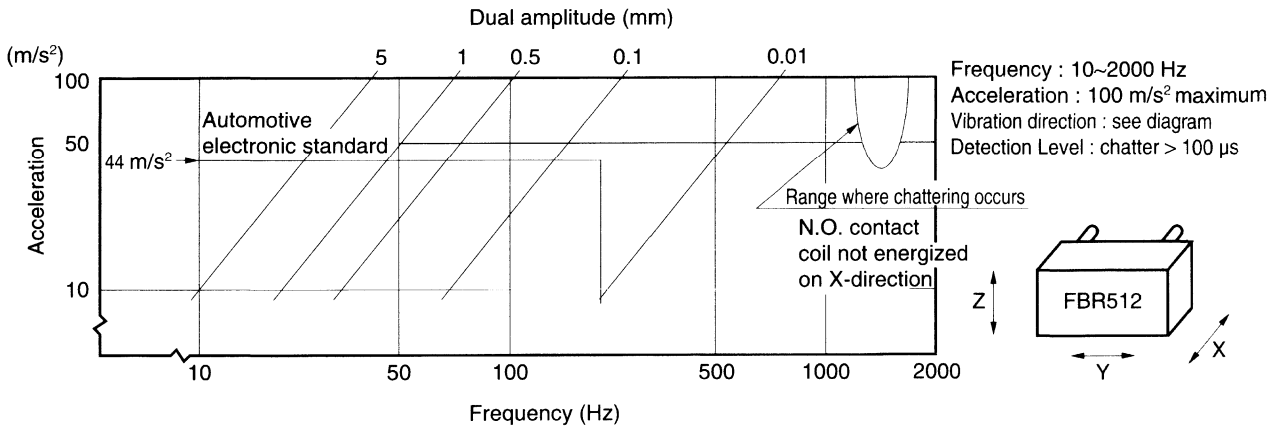
[FBR512ND09-W]

[FBR512ND12-W]

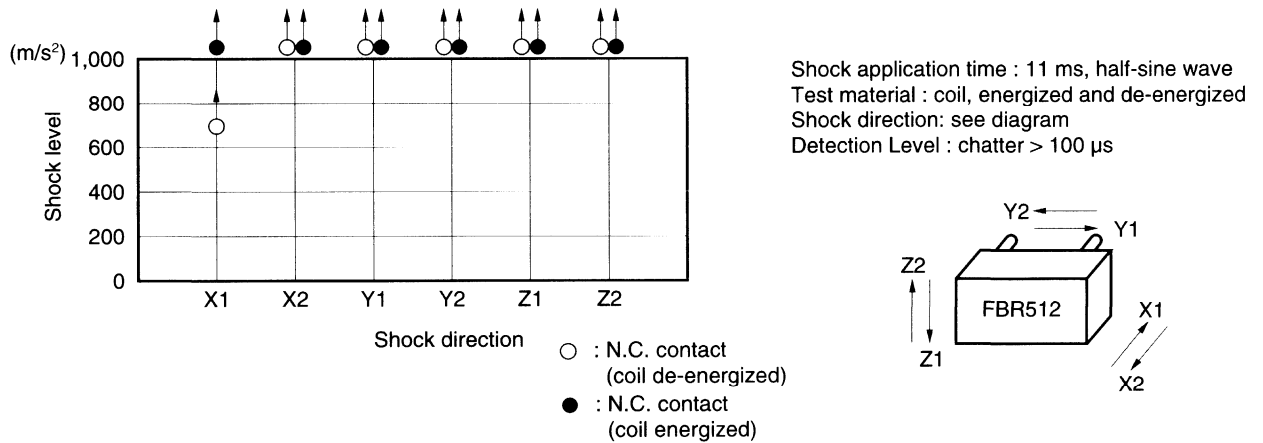


FBR512, 522 SERIES

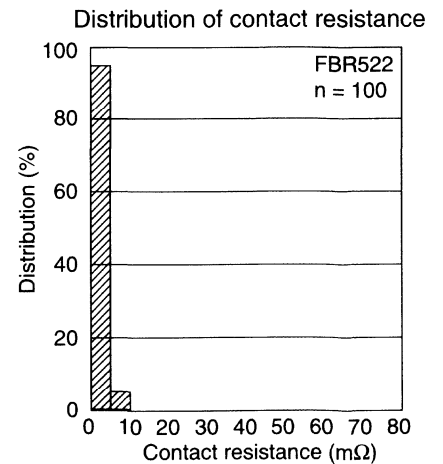
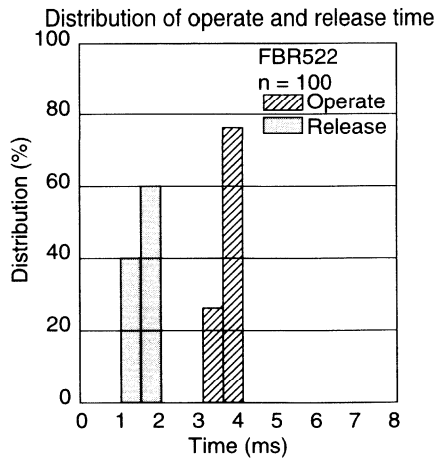
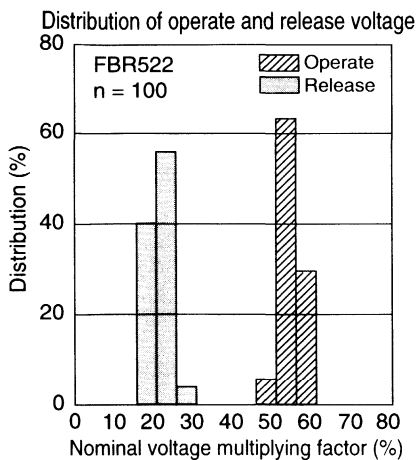
6. VIBRATION RESISTANCE CHARACTERISTICS



7. SHOCK RESISTANCE CHARACTERISTICS



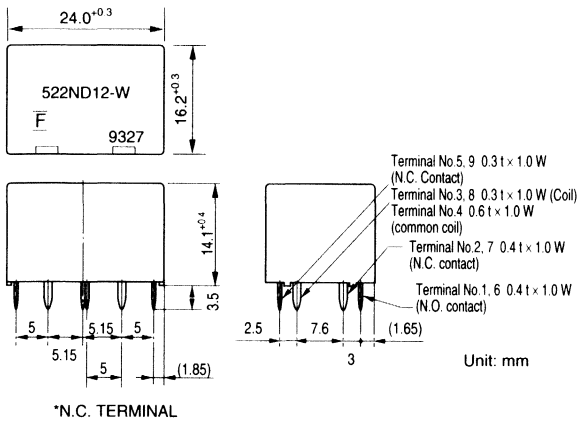
REFERENCE DATA



FBR512, 522 SERIES

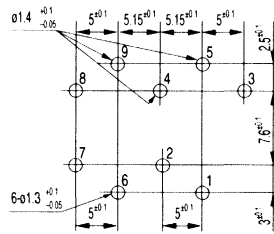
■ DIMENSIONS

● Dimensions

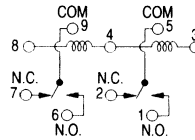


*N.C. TERMINAL

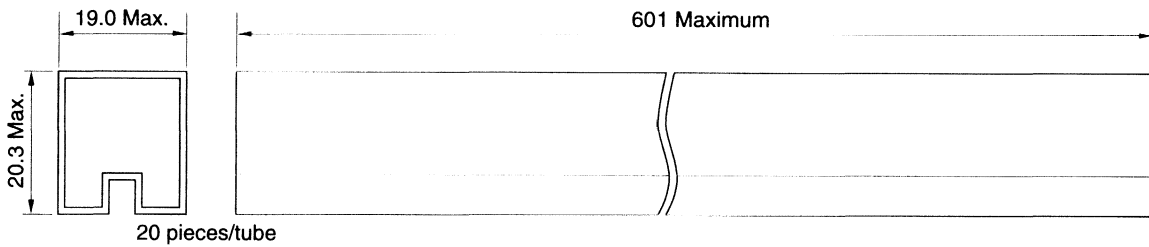
● PC board mounting hole layout (BOTTOM VIEW)



● Schematic (BOTTOM VIEW)



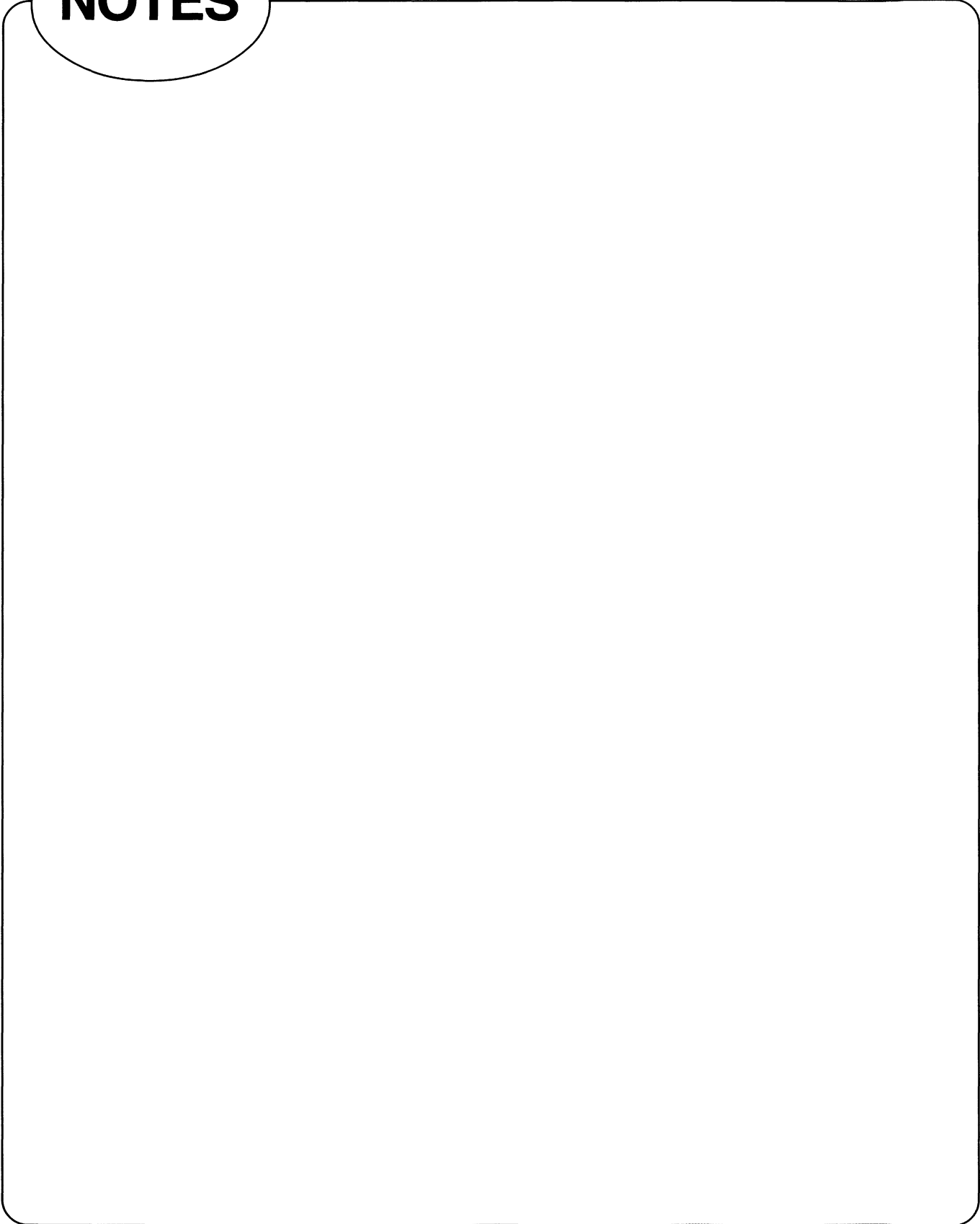
● Tube carrier



Unit: mm

FBR512, 522 SERIES

NOTES



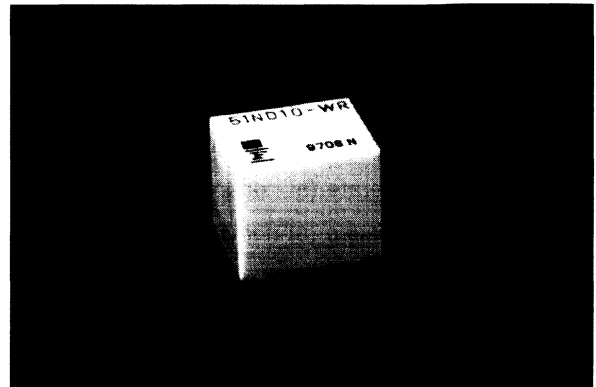
COMPACT POWER RELAY

1 POLE-20 A (AUTOMOTIVE APPLICATIONS RELAY FOR FLASHER LAMP LOAD)

FBR51,512 (-WR) SERIES

■ FEATURES

- Relay for flasher lamp load (automotive application) newly added to our compact power relay, FBR51 Series and 512 Series.
- Long life
Special contact allows more than 4 million operations at flasher lamp load of 16 V DC, 28 A inrush, rated 135 W.



■ ORDERING INFORMATION

[Example] FBR51 N D12 - WR -**
 (a) (b) (c) (d) (e)

| | | |
|-----|--------------------|--|
| (a) | Series Name | FBR51 : FBR51 Series (contact gap 0.3 mm) FBR512 : FBR512 Series (contact gap 0.3 mm) |
| (b) | Structure | N : Plastic sealed type |
| (c) | Nominal Voltage | D09 : 9 VDC D10 : 10 VDC D12 : 12 VDC |
| (d) | Contact Material | WR : Special contact * |
| (e) | Custom Designation | To be assigned custom specification |

* The contact materials of the movable and stationary contacts are different. Therefore, the specified load polarity must be observed to achieve rated life. Refer to life test examples and schematic.

FBR51,512 (-WR) SERIES

■ SPECIFICATIONS

| Item | | FBR51 Series | FBR512 Series |
|------------|--|---|------------------------|
| Contact | Arrangement | 1 form A | 1 form A x 2 |
| | Material | Special contact | |
| | Voltage Drop (resistance) | Maximum 100 mV (at 1 A 12 VDC) | |
| | Ratings | 14 VDC–135 W (load: tungsten lamp) | |
| | Maximum Carrying Current | 25 A/ 1 hour (25°C, 100% rated coil voltage) | |
| | Max. Inrush Current (reference) | 60 A | |
| | Max. Switching Current (reference) | 35 A 16 VDC | |
| | Min. Switching Load*1 (reference) | 6 VDC, 1 A | |
| Coil | Operating Temperature | –40°C to + 85°C (no frost) | |
| | Storage Temperature | –40°C to +100°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | |
| | Electrical | 4 x 10 ⁶ operations minimum 16 VDC inrush 28 A (0.5s ON, 0.5s OFF), 135 W (load: tungsten lamp) | |
| Other | Vibration Resistance | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | Shock Resistance | Misoperation | 100 m/s ² |
| | | Endurance | 1,000 m/s ² |
| | Weight | Approximately 6 g | Approximately 13 g |
| Polarity | N.O. Terminal: (+)side COM. Terminal: (–)side | | |

*1 Values when switching a resistive load at normal room temperature and humidity and in a clean environment.
The minimum switching load varies with the switching frequency and operating environment.

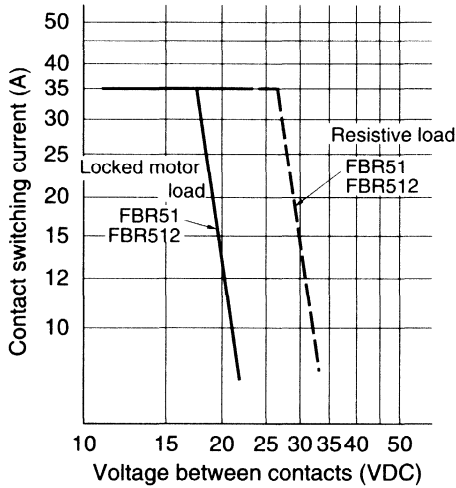
■ COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance (±10%) (at 20°C) | Must operate voltage | Thermal resistance |
|--------------|---------------|-----------------|----------------------------------|--|--------------------|
| FBR51 Series | FBR512 Series | | | | |
| FBR51ND09-WR | FBR512ND09-WR | 9 VDC | 135Ω | 5.4 VDC (at 20°C) 6.8 VDC (at 85°C) | 73°C/W |
| FBR51ND10-WR | FBR512ND10-WR | 10 VDC | 180Ω | 6.3 VDC (at 20°C) 7.9 VDC (at 85°C) | |
| FBR51ND12-WR | FBR512ND12-WR | 12 VDC | 240Ω | 7.3 VDC (at 20°C) 9.0 VDC (at 85°C) | |

FBR51,512 (-WR) SERIES

■ CHARACTERISTIC DATA

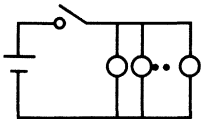
1. MAXIMUM BREAK CAPACITY



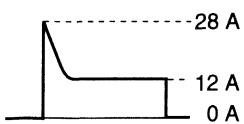
2. LIFE TEST (EXAMPLES)

- Test item
16 VDC, inrush 28 A
Tungsten lamp load
(12 V 23 W×5 pieces+
12 V 10 W×2 pieces)
0.5s ON, 0.5s OFF

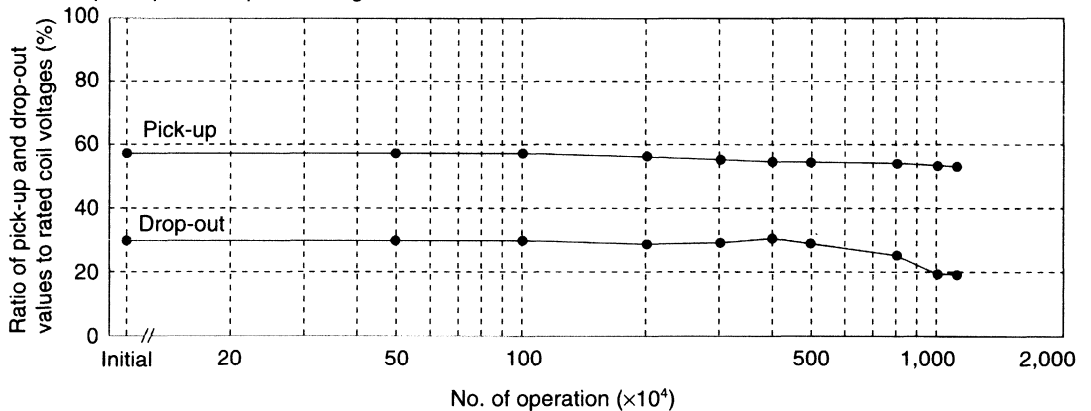
•Test circuit



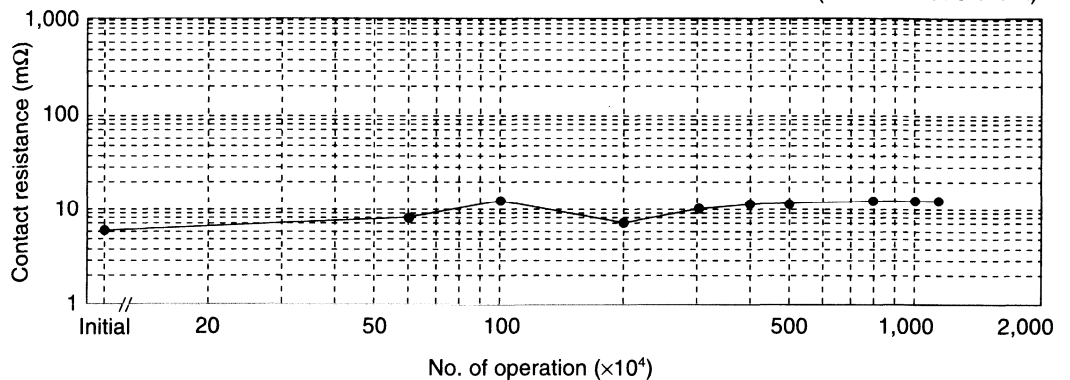
•Circuit wave form



•Shift of pick-up and drop-out voltage



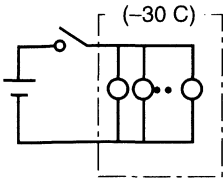
•Shift of contact resistance



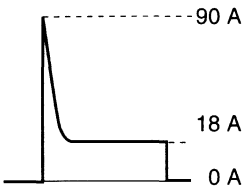
FBR51,512 (-WR) SERIES

•Test item
 16 VDC, inrush 90 A
 Tungsten lamp load
 (12 V 23 W×5 pieces+
 12 V 10 W×2 pieces)
 0.25s ON, 4.75s OFF

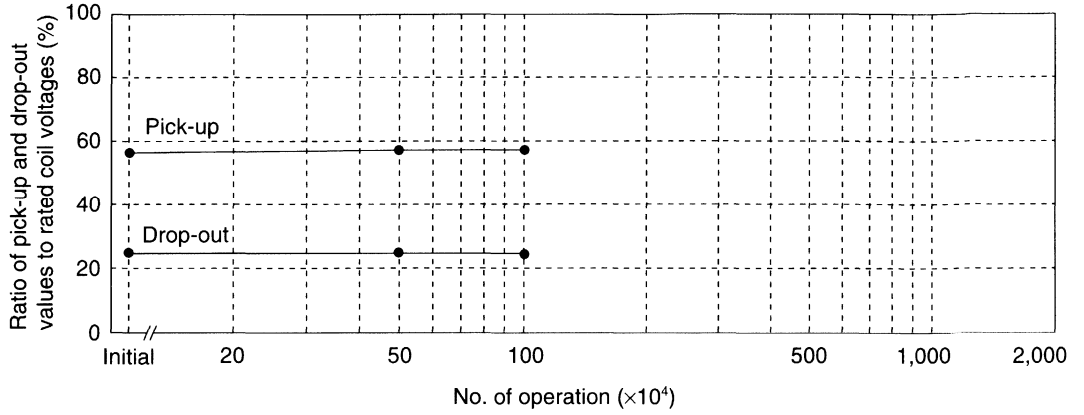
•Test circuit



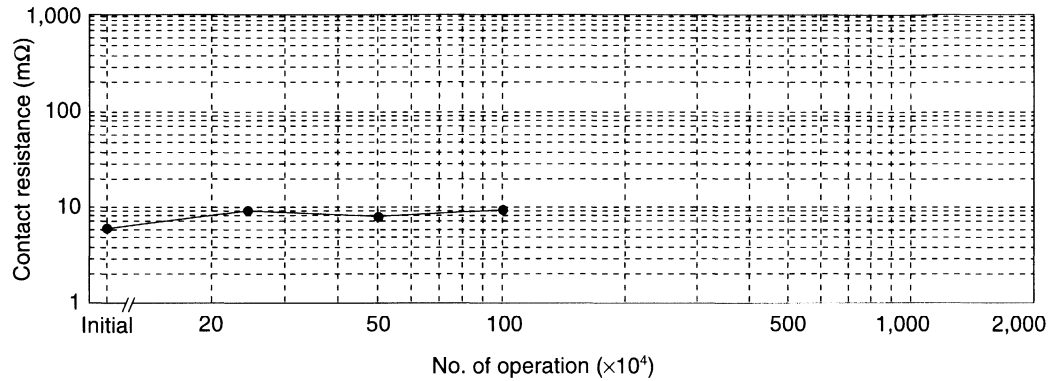
•Circuit wave form



•Shift of pick-up and drop-out voltage

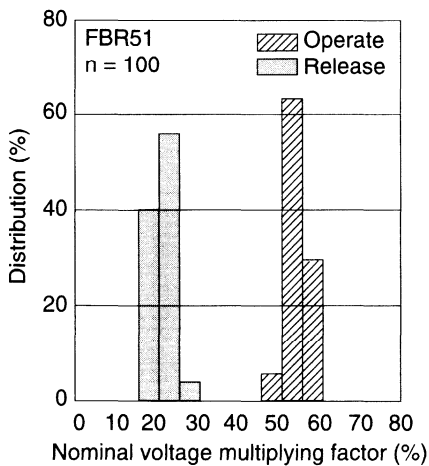


•Shift of contact resistance

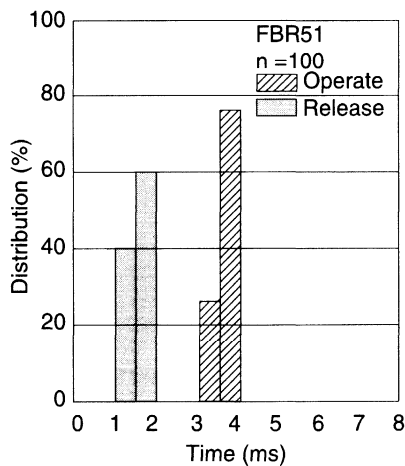


REFERENCE DATA

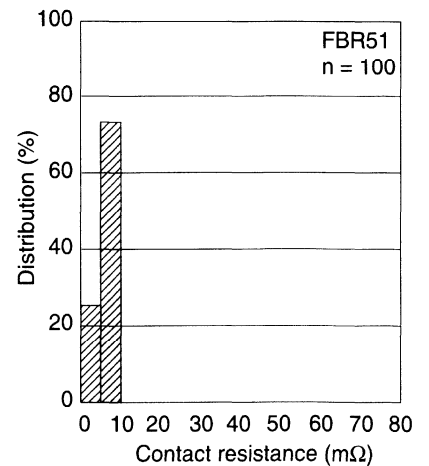
Distribution of operate and release voltage



Distribution of operate and release time



Distribution of contact resistance



FBR51,512 (-WR) SERIES

NOTES



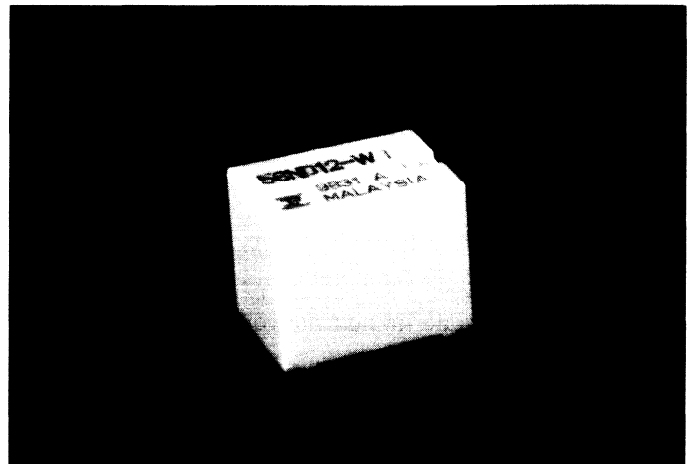
COMPACT HIGH POWER RELAY

1 POLE—30 A (FOR AUTOMOTIVE APPLICATIONS)

FBR56 SERIES

■ FEATURES

- High power contact capacity
(carrying current: 40 A/2 minutes, 30 A/1 hour)
- High heat resistance and extended operating voltage



■ ORDERING INFORMATION

[Example] $\frac{\text{FBR56}}{\text{(a)}} \quad \frac{\text{N}}{\text{(b)}} \quad \frac{\text{D12}}{\text{(c)}} \quad - \quad \frac{\text{W}}{\text{(d)}} \quad \frac{\text{**}}{\text{(e)}}$

| | | |
|-----|--------------------|--|
| (a) | Series Name | FBR56 : FBR56 Series relay for 12 V battery (contact gap 0.4 mm) |
| (b) | Enclosure | N : Plastic sealed type |
| (c) | Nominal Voltage | D06 : 6 VDC D09 : 9 VDC D12 : 12 VDC |
| (d) | Contact Material | W : Silver-tin oxide indium N : Silver copper nickel |
| (e) | Custom Designation | To be assigned custom specification |

FBR56 SERIES

■ SPECIFICATIONS

| Item | | Specifications | |
|------------|------------------------------|--|------------------------|
| Contact | Arrangement | 1 form C | |
| | Material | Silver-tin oxide indium (-W type) Silver copper nickel (-N type) | |
| | Voltage Drop (resistance) | Maximum 100 mV (at 2 A 12 VDC) | |
| | Ratings | 14 VDC 20 A (locked motor load) 14 VDC inrush 20 A, break 4 A (motor free load) | |
| | Maximum Carrying Current | 40 A/2 minutes, 30 A/1 hour (25°C, 100% rated coil voltage) | |
| | Maximum Inrush Current | -W type: 60 A (reference) -N type: 40 A | |
| | Maximum Switching Current | 40 A 16 VDC (reference) | |
| | Minimum Switching Load*1 | -W type: 6 VDC, 1 A -N type: 6 VDC, 2 A (reference) | |
| Coil | Operating Temperature | -40°C to +85°C (no frost) (refer to the CHARACTERISTIC DATA) | |
| | Storage Temperature | -40°C to +100°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | |
| | Electrical | 100 x 10 ³ operations minimum (locked motor load) 1 x 10 ⁶ operations minimum (motor free load) | |
| Other | Vibration Resistance | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | Shock Resistance | Misoperation | 100 m/s ² |
| | | Endurance | 1,000 m/s ² |
| | Weight | Approximately 9.4 g | |

*1 Values when switching a resistive load at normal room temperature and humidity, and in a clean environment. The minimum switching load varies with the switching frequency and operating environment.

■ COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance (±10%) (at 20°C) | Must operate voltage | Thermal resistance |
|-------------|-------------|-----------------|----------------------------------|--|--------------------|
| W contact | N contact | | | | |
| FBR56ND06-W | FBR56ND06-N | 6 VDC | 42Ω | 3.6 VDC (at 20°C) 4.5 VDC (at 85°C) | 77°C/W |
| FBR56ND09-W | FBR56ND09-N | 9 VDC | 95Ω | 5.4 VDC (at 20°C) 6.8 VDC (at 85°C) | |
| FBR56ND12-W | FBR56ND12-N | 12 VDC | 170Ω | 7.3 VDC (at 20°C) 9.2 VDC (at 85°C) | |

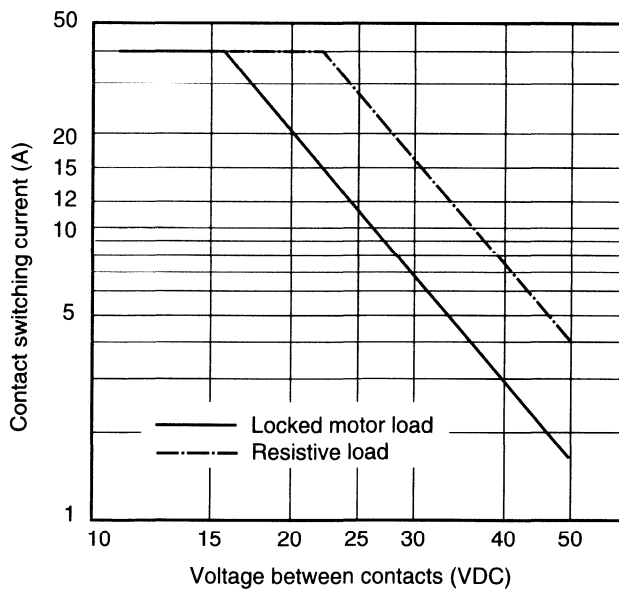
FBR56 SERIES

■ PRINCIPAL APPLICATIONS

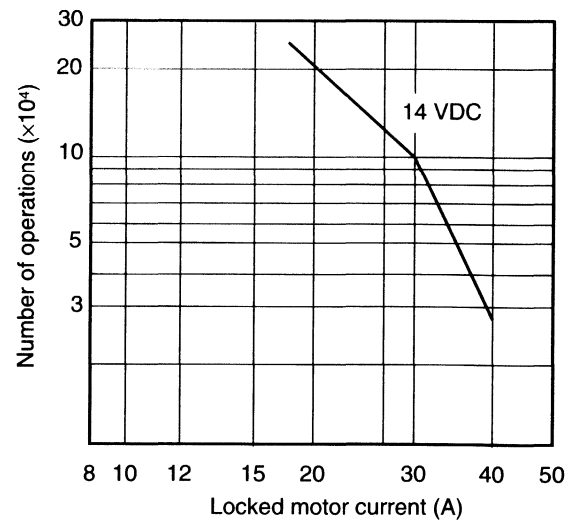
| Application | | Normal load current | Life x 10 ³ | Recommended model (Example) |
|------------------|---------------------|---|------------------------|-----------------------------|
| For 12 V battery | Power Windows | 20 to 30 A (switching at motor locking) | 100 | FBR56N11-W |
| | Automatic Door Lock | 18 to 30 A/4 to 5 door (switching at motor locking) | 100 | FBR56N11-W |
| | Intermittent Wipers | INRUSH 15 to 30 A BREAK 2 to 8 A (motor free) | 300 | FBR56N11-N |
| | Tilt-Lock Wheel | INRUSH 15 A BREAK 2.5 A (motor free) | 100 | FBR56N11-W |
| | Sunroof | 20 to 30 A (switching at motor locking) | 100 | FBR56N11-W |
| | Others | Car audio system, etc. | — | FBR56N11-W |

■ CHARACTERISTIC DATA

1. MAXIMUM BREAK CAPACITY



2. LIFE

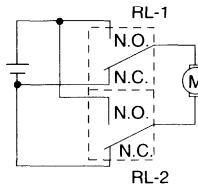


FBR56 SERIES

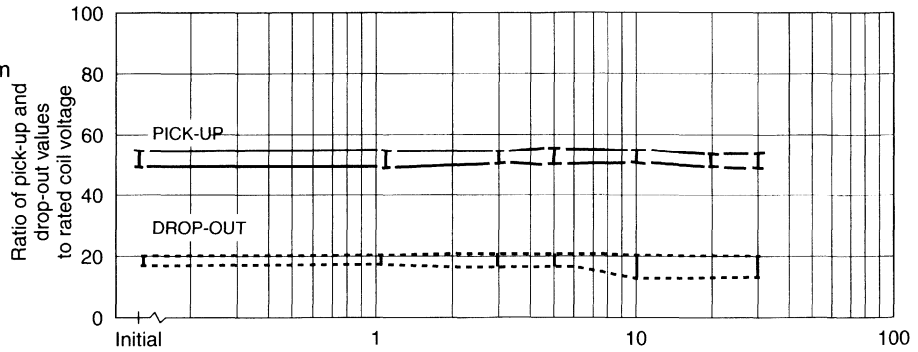
3. LIFE TEST (EXAMPLE)

- Test item
14 V DC-20 A
Motor lock
200,000 operations minimum
(FBR56 □-W type)

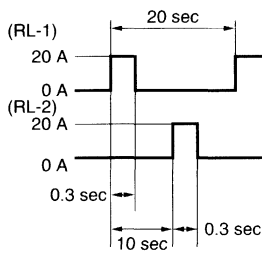
- Test circuit



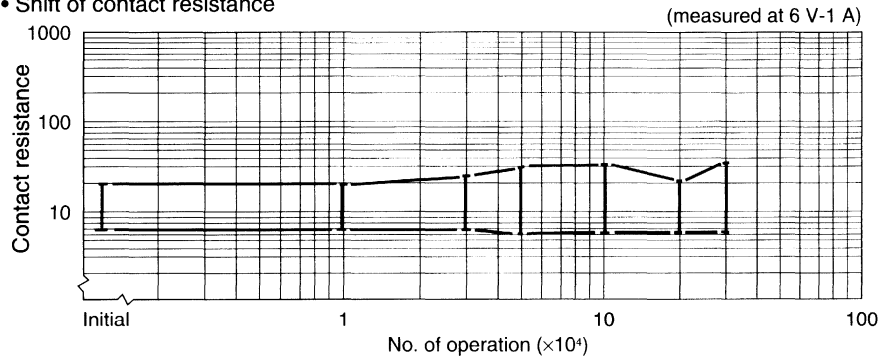
- Shift of pick-up and drop-out voltage



- Current wave form

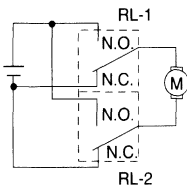


- Shift of contact resistance

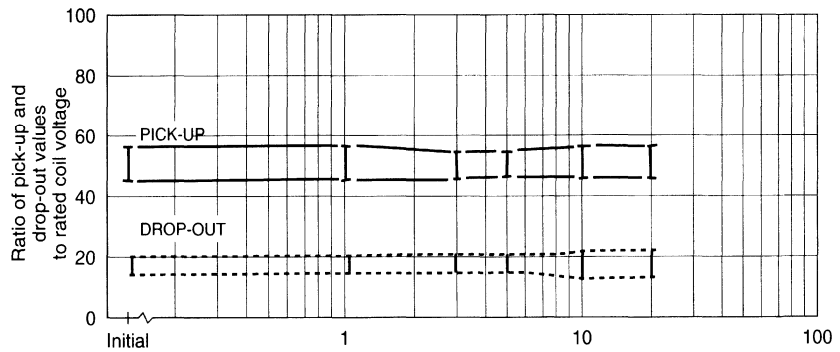


- Test item
14 V DC-30 A
Motor lock
100,000 operations minimum
(FBR56 □-W type)

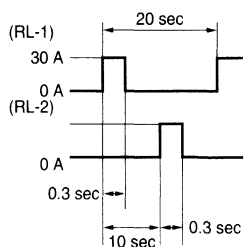
- Test circuit



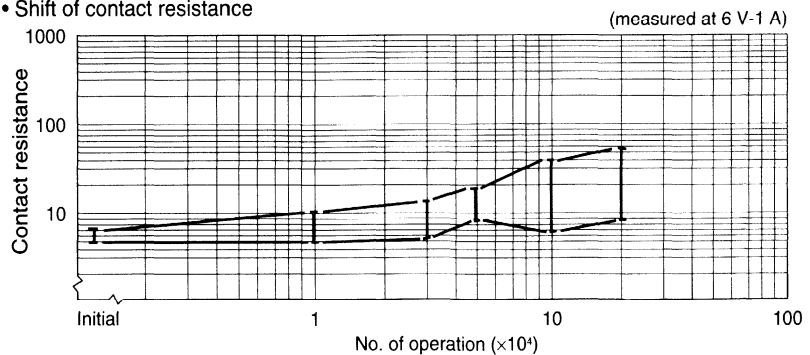
- Shift of pick-up and drop-out voltage



- Current wave form



- Shift of contact resistance

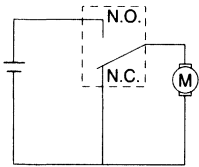


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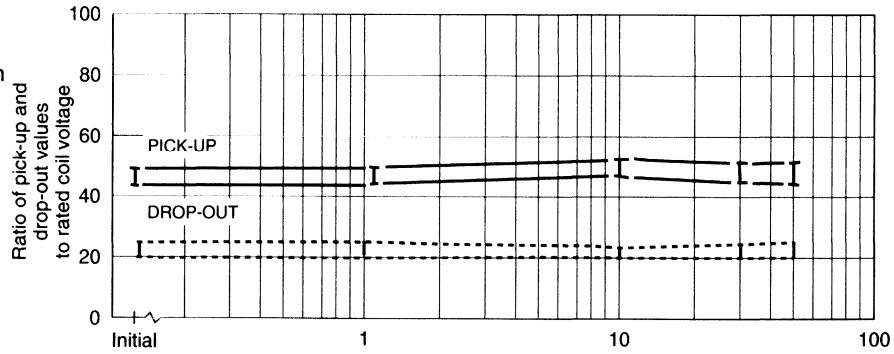
FBR56 SERIES

(Continued)

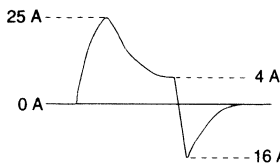
- Test item
16 V DC-25 A INRUSH
Motor free
400,000 operations minimum
(FBR56 □-N type)
- Test circuit



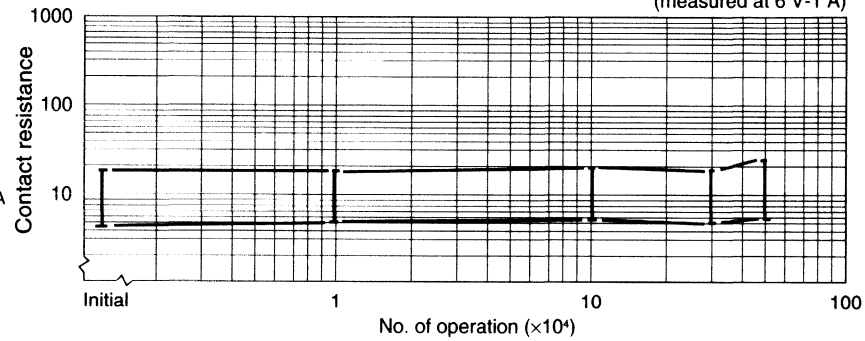
- Shift of pick-up and drop-out voltage



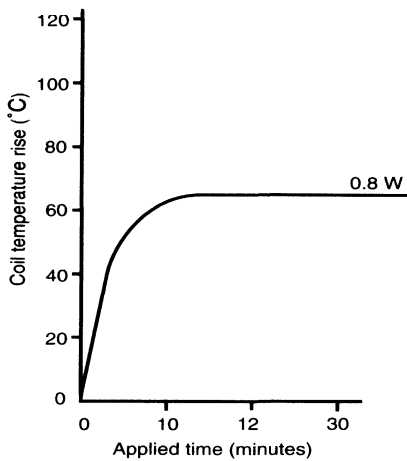
- Current wave form



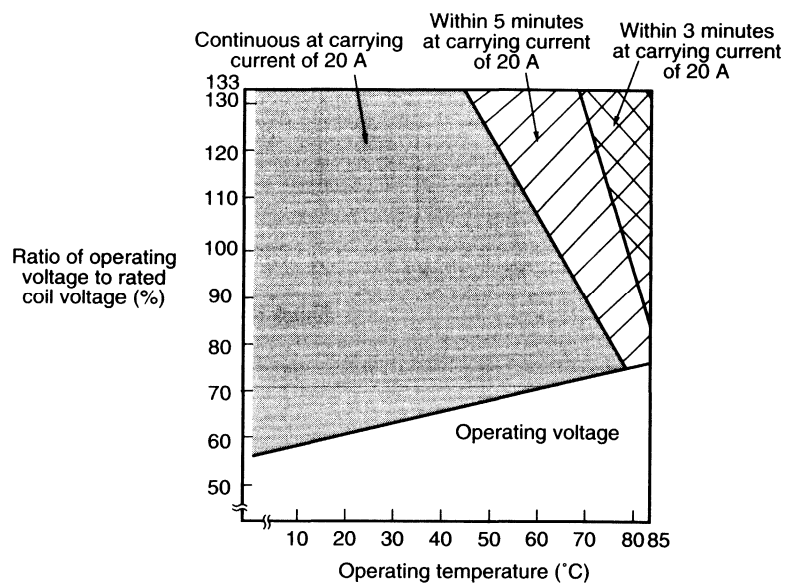
- Shift of contact resistance



4. COIL TEMPERATURE RISE

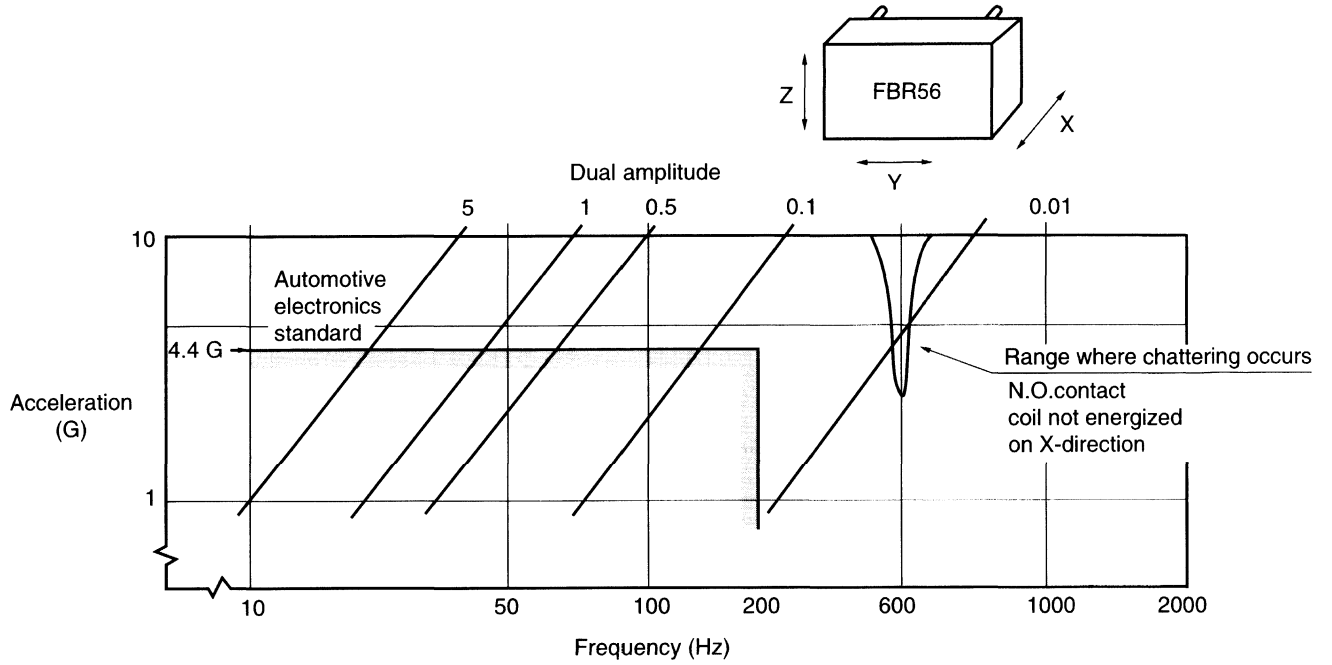


5. OPERATING COIL VOLTAGE RANGE (EXAMPLE)

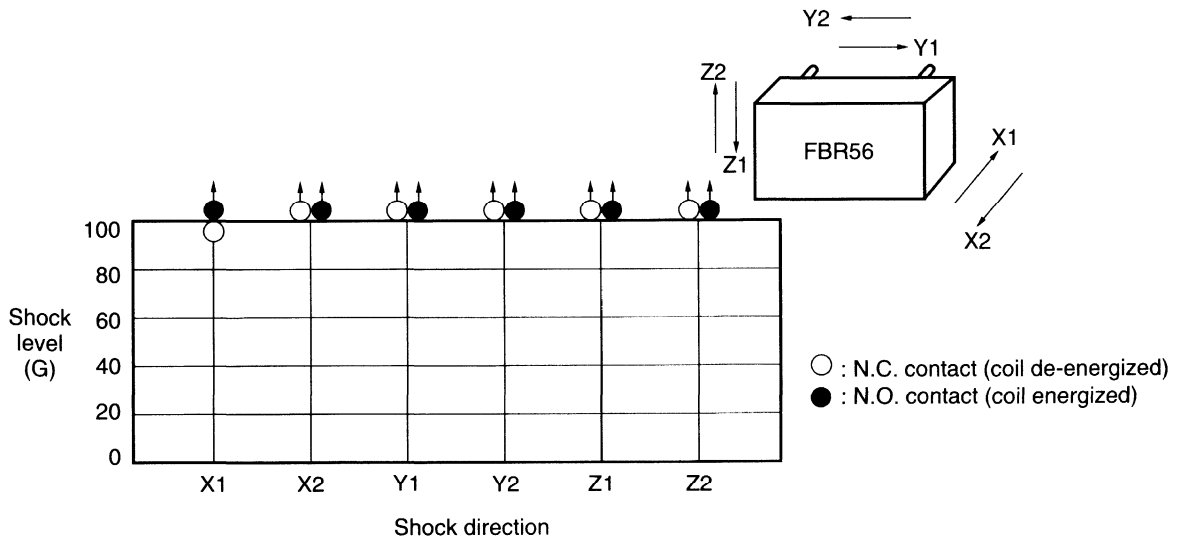


FBR56 SERIES

6. VIBRATION RESISTANCE CHARACTERISTICS

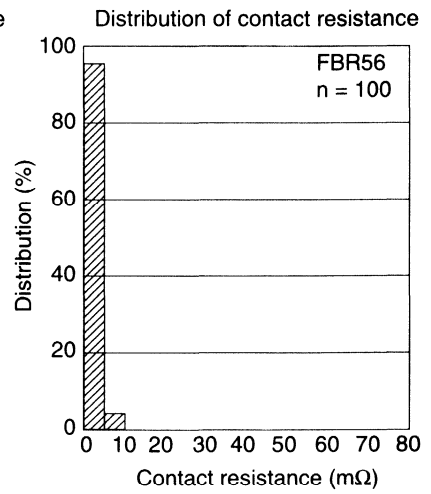
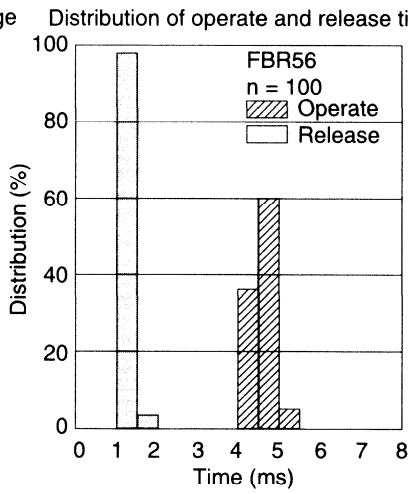
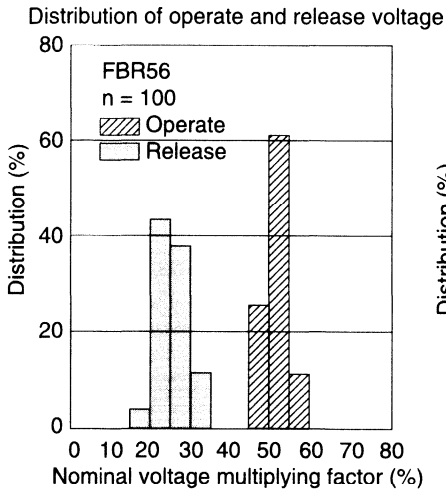


7. SHOCK RESISTANCE CHARACTERISTICS



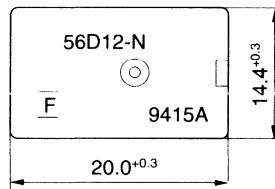
FBR56 SERIES

REFERENCE DATA

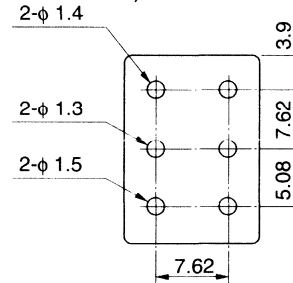


DIMENSIONS

Dimensions



PC board mounting hole layout (BOTTOM VIEW)

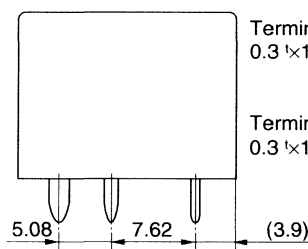
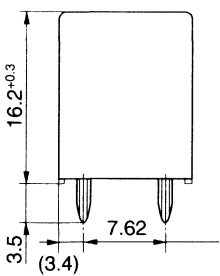
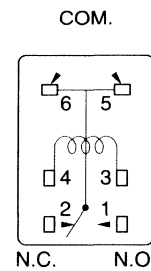


Terminal No.1, 2
0.5 × 1.2^w

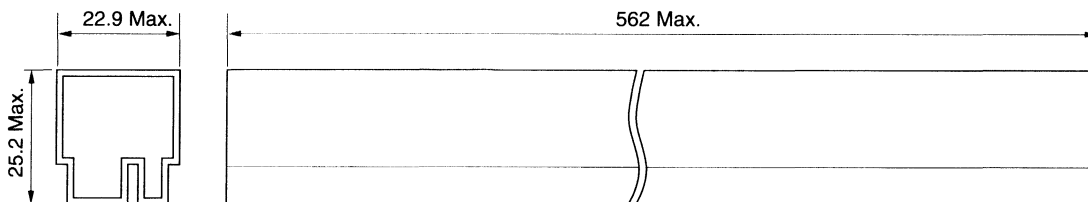
Schematics (BOTTOM VIEW)

Terminal No.3, 4
0.3 × 1.0^w

Terminal No.5, 6
0.3 × 1.2^w



Tube carrier



35 pcs/tube

Unit : mm

FBR56 SERIES

NOTES



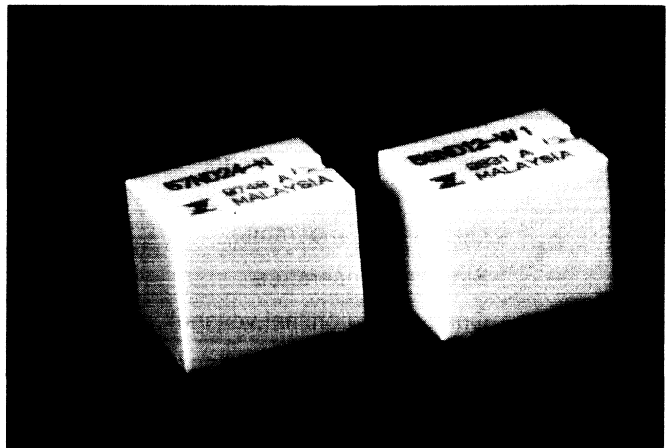
COMPACT HIGH POWER RELAY

1 POLE-12 A (28 VDC) (FOR 24 V BATTERY AUTOMOTIVE APPLICATIONS)

FBR57 SERIES

■ FEATURES

- High power contact capacity
(carrying current: 40 A/2 minutes, 30 A/1 hour)
- Suitable for controlling 24 V motors in trucks and other large vehicles
- High heat resistance and extended operating voltage



■ ORDERING INFORMATION

[Example] FBR57 N D24 - W **
 (a) (b) (c) (d) (e)

| | | |
|-----|--------------------|--|
| (a) | Series Name | FBR57 : FBR57 Series relay for 24 V battery (contact gap 0.8 mm) |
| (b) | Enclosure | N : Plastic sealed type |
| (c) | Nominal Voltage | D24 : 24 VDC |
| (d) | Contact Material | W : Silver-tin oxide indium N : Silver copper nickel |
| (e) | Custom Designation | To be assigned custom specification |

FBR57 SERIES

■ SPECIFICATIONS

| Item | | Specifications | |
|------------|------------------------------|--|------------------------|
| Contact | Arrangement | 1 form C | |
| | Material | Silver-tin oxide indium (-W type) Silver copper nickel (-N type) | |
| | Voltage Drop (resistance) | Maximum 100 mV (at 2 A 12 VDC) | |
| | Ratings | 28 VDC 12 A (locked motor load) 28 VDC inrush 15 A, break 2.5 A (motor free load) | |
| | Maximum Carrying Current | 40 A/2 minutes, 30 A/1 hour (25°C, 100% rated coil voltage) | |
| | Maximum Inrush Current | -W type: 60 A (reference) -N Type: 40 A | |
| | Maximum Switching Current | 12 A 28 VDC (reference) | |
| | Minimum Switching Load*1 | -W type: 6 VDC, 1 A -N type: 6 VDC, 2 A (reference) | |
| Coil | Operating Temperature | -40°C to +85°C (no frost) (refer to the CHARACTERISTIC DATA) | |
| | Storage Temperature | -40°C to +100°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | |
| | Electrical | 100 x 10 ³ operations minimum (locked motor load) 500 x 10 ³ operations minimum (motor free load) | |
| Other | Vibration Resistance | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | Shock Resistance | Misoperation | 100 m/s ² |
| | | Endurance | 1,000 m/s ² |
| | Weight | Approximately 9.4 g | |

*1 Values when switching a resistive load at normal room temperature and humidity, and in a clean environment.
The minimum switching load varies with the switching frequency and operating environment.

■ COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance (±10%) (at 20°C) | Must operate voltage | Thermal resistance |
|-------------|-------------|-----------------|-------------------------------------|--|--------------------|
| W contact | N contact | | | | |
| FBR57ND24-W | FBR57ND24-N | 24 VDC | 384Ω | 14.4 VDC (at 20°C) 18.0 VDC (at 85°C) | 67°C/W |

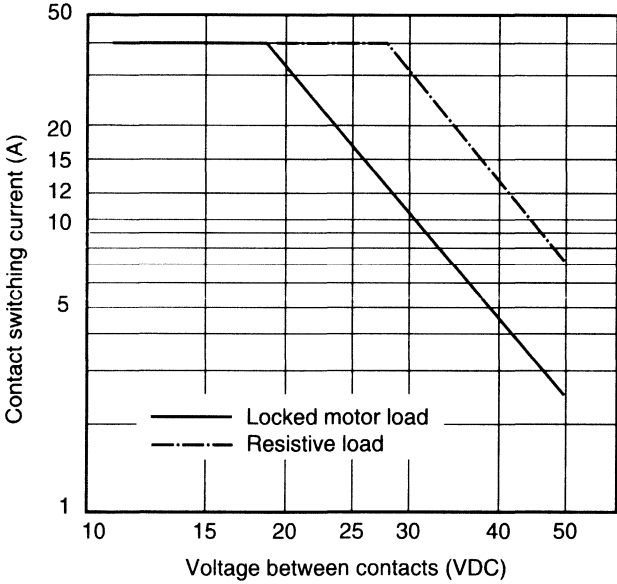
FBR57 SERIES

■ PRINCIPAL APPLICATIONS

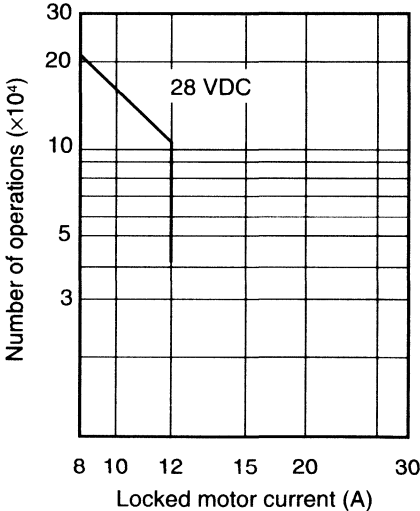
| Application | | Normal load current | Life x 10 ³ | Recommended model (example) |
|------------------|---------------------|--|------------------------|-----------------------------|
| For 24 V battery | Power Windows | 10 to 12 A (switching at motor locking) | 100 | FBR57N I-W |
| | Automatic Door Lock | 5 A/2 door (switching at motor locking) | 100 | FBR57N I-W |
| | Intermittent Wipers | INRUSH 15 to 30 A BREAK 2 to 8 (motor free) | 300 | FBR57N I-N |

■ CHARACTERISTIC DATA

1. MAXIMUM BREAK CAPACITY



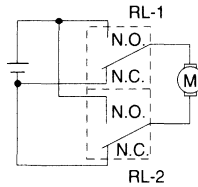
2. LIFE



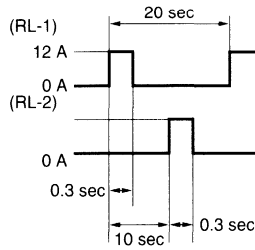
FBR57 SERIES

3. LIFE TEST (EXAMPLE)

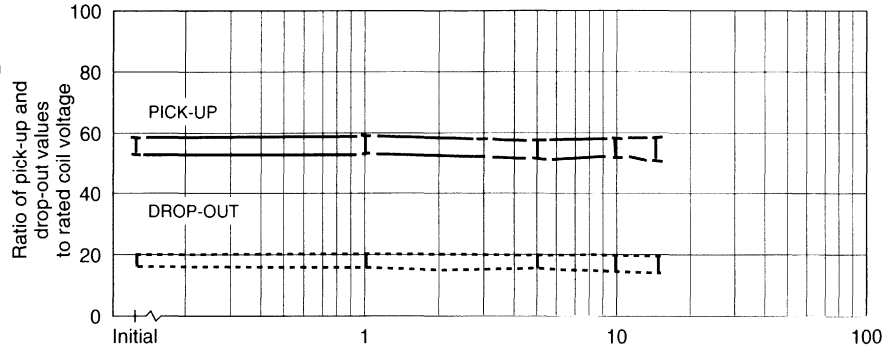
- Test item
28 V DC-12 A INRUSH
Motor lock
100,000 operations minimum
(FBR57□-W type)
- Test circuit



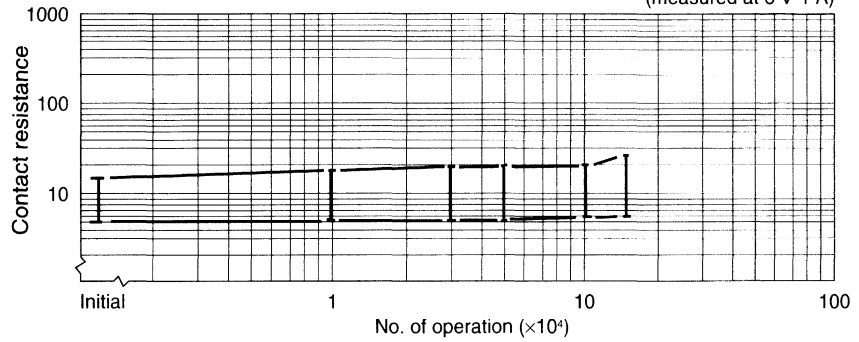
- Current wave form



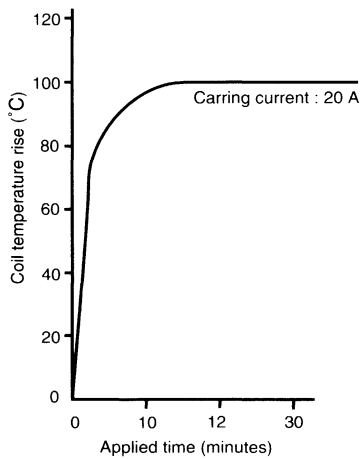
- Shift of pick-up and drop-out voltage



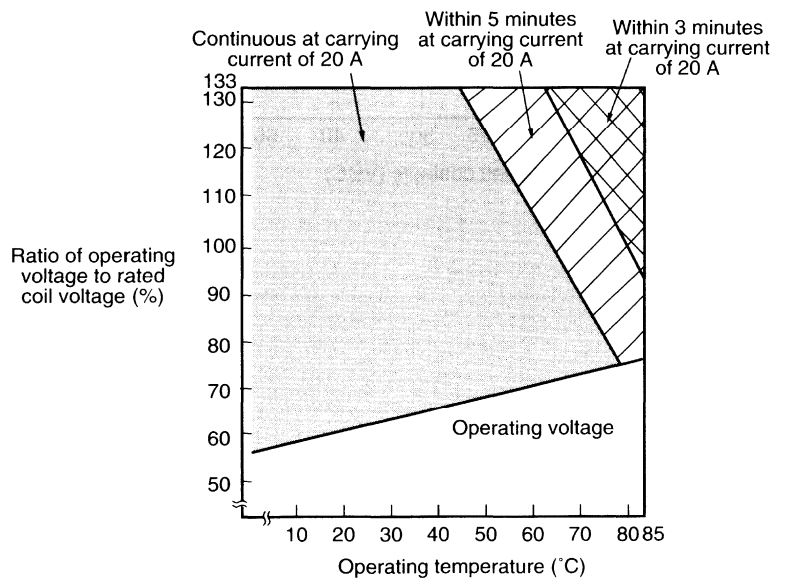
- Shift of contact resistance



4. COIL TEMPERATURE RISE

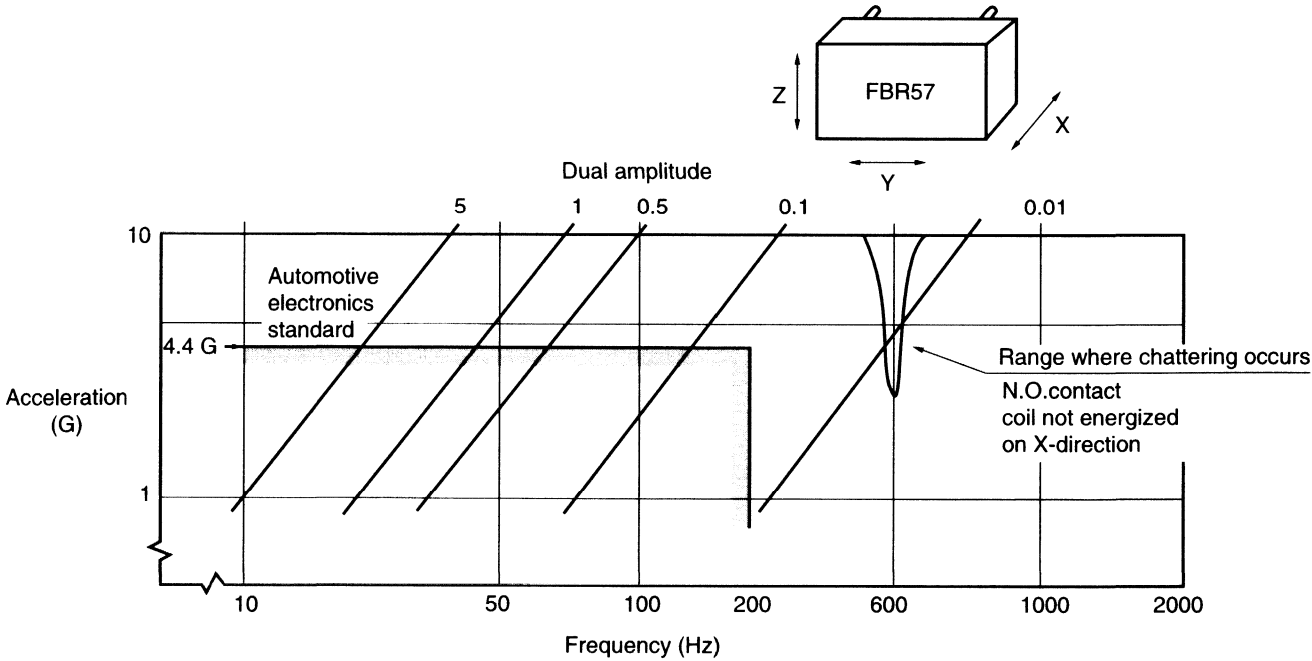


5. OPERATING COIL VOLTAGE RANGE (EXAMPLE)

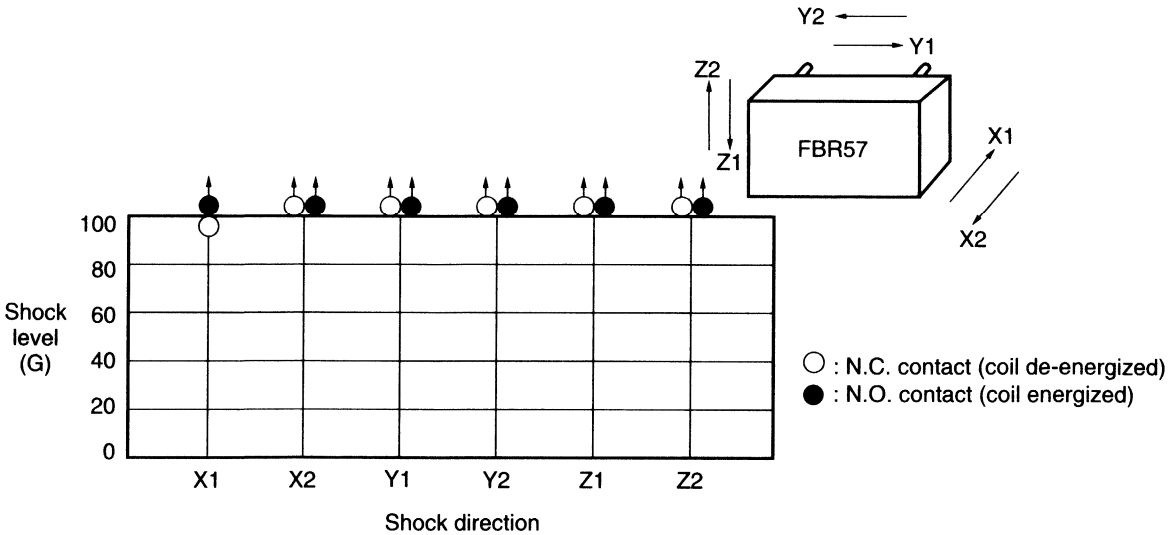


FBR57 SERIES

6. VIBRATION RESISTANCE CHARACTERISTICS

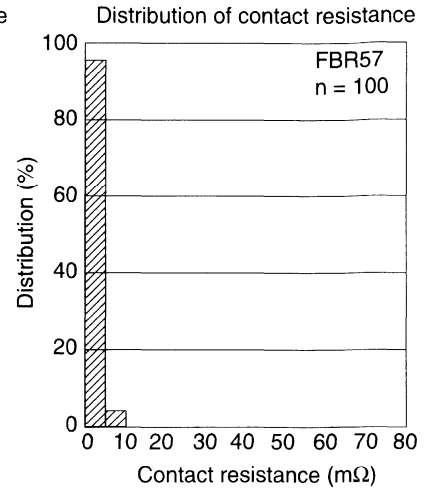
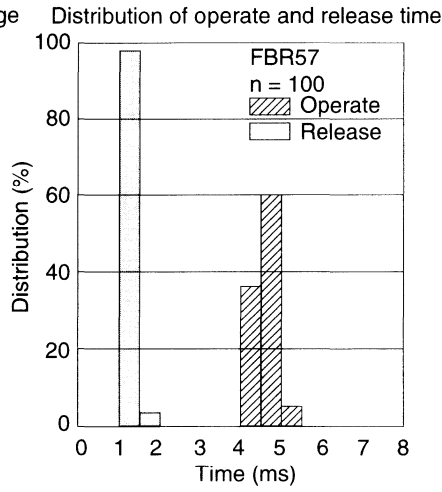
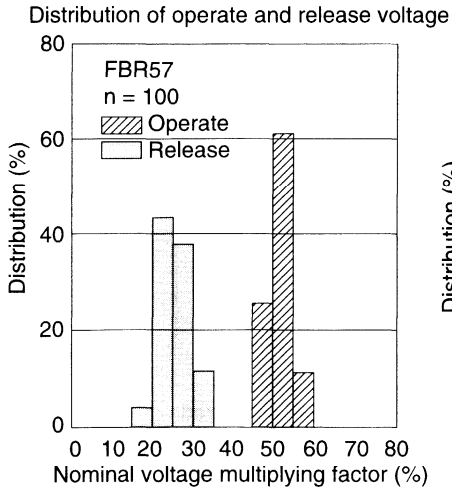


7. SHOCK RESISTANCE CHARACTERISTICS



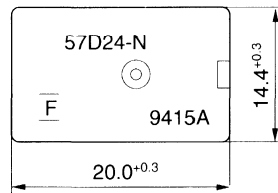
FBR57 SERIES

REFERENCE DATA

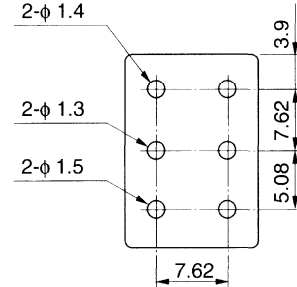


DIMENSIONS

Dimensions

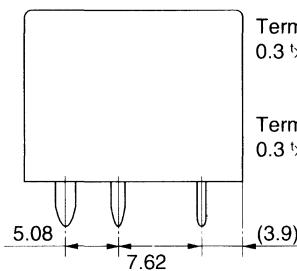
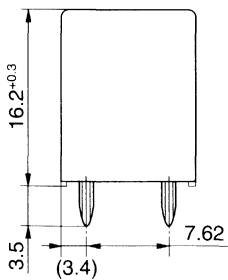


PC board mounting hole layout (BOTTOM VIEW)



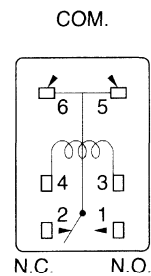
Terminal No.1, 2
0.5 × 1.2 w

Schematic (BOTTOM VIEW)

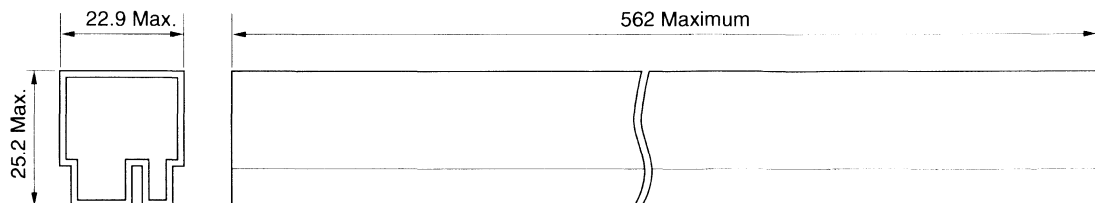


Terminal No.3, 4
0.3 × 1.0 w

Terminal No.5, 6
0.3 × 1.2 w



Tube carrier



35 pieces/tube

Unit : mm

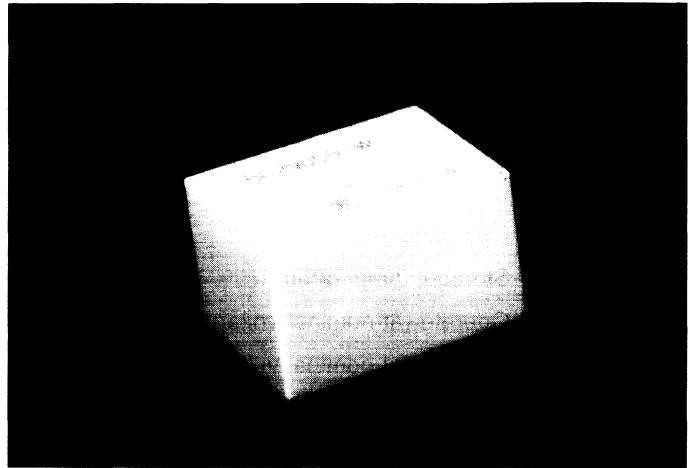
HIGH POWER TWIN RELAY

1 POLE x 2—30A (FOR AUTOMOTIVE APPLICATIONS)

FBR562 SERIES

■ FEATURES

- Two independent relays mounted in a single package (43% of the volume of the two FRL-270 relays)
- High current contact capacity (carrying current: 40 A/2 minutes, 30 A/1 hour)
- High heat resistance and extended operating voltage



■ ORDERING INFORMATION

[Example] $\frac{\text{FBR562}}{\text{(a)}} \frac{\text{N}}{\text{(b)}} \frac{\text{D12}}{\text{(c)}} - \frac{\text{W}}{\text{(d)}} \frac{\text{**}}{\text{(e)}}$

| | | |
|-----|--------------------|---|
| (a) | Series Name | FBR562: FBR562 Series relay for 12 V battery (contact gap 0.4 mm) |
| (b) | Enclosure | N : Plastic sealed type |
| (c) | Nominal Voltage | D06 : 6 VDC D09 : 9 VDC D12 : 12 VDC |
| (d) | Contact Material | W : Silver-tin oxide indium N : Silver copper nickel |
| (e) | Custom Designation | To be assigned custom specification |

FBR562 SERIES

■ SPECIFICATIONS

| Item | | Specifications | |
|------------|--------------------------------------|--|--|
| Contact | Arrangement | 1 form C x 2 (SPDT x 2) | |
| | Material | Silver-tin oxide indium (-W type) Silver copper nickel (-N type) | |
| | Voltage Drop (resistance) | Maximum 100 mV (at 2 A 12 VDC) | |
| | Ratings | 14 VDC 20 A (locked motor load) 14 VDC inrush 20 A, break 4 A (motor free load) | |
| | Maximum Carrying Current | 40 A/2 minutes, 30 A/ 1 hour (25°C, 100% rated coil voltage) | |
| | Maximum Inrush Current (reference) | -W type: 60 A -N type: 40 A | |
| | Max. Switching Current (reference) | 40 A 16 VDC | |
| | Minimum Switching Load*1 (reference) | -W type: 6 VDC 1 A -N type: 6 VDC 2 A | |
| Coil | Operating Temperature | -40°C to +85°C (no frost) (refer to the CHARACTERISTIC DATA) | |
| | Storage Temperature | -40°C to +100°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | |
| | Electrical | 100 x 10 ³ operations minimum (locked motor load) 1 x 10 ⁶ operations minimum (motor free Load) | |
| Other | Vibration Resistance | | 10 to 55 Hz (double amplitude of 1.5 mm) |
| | Shock Resistance | Misoperation | 100 m/s ² |
| | | Endurance | 1,000 m/s ² |
| | Weight | | Approximately 18 g |

*1 Values when switching a resistive load at normal room temperature and humidity and in a clean environment. The minimum switching load varies with the switching frequency and operating environment.

■ COIL DATA CHART

| MODEL | | Nominal voltage | Coil resistance (±10%) (at 20°C) | Must operate voltage | Thermal resistance |
|--------------|--------------|-----------------|----------------------------------|--|--------------------|
| W contact | N contact | | | | |
| FBR562ND06-W | FBR562ND06-N | 6 VDC | 42Ω | 3.6 VDC (at 20°C) 4.5 VDC (at 85°C) | 77°C/W |
| FBR562ND09-W | FBR562ND09-N | 9 VDC | 95Ω | 5.4 VDC (at 20°C) 6.8 VDC (at 85°C) | |
| FBR562ND12-W | FBR562ND12-N | 12 VDC | 170Ω | 7.3 VDC (at 20°C) 9.2 VDC (at 85°C) | |

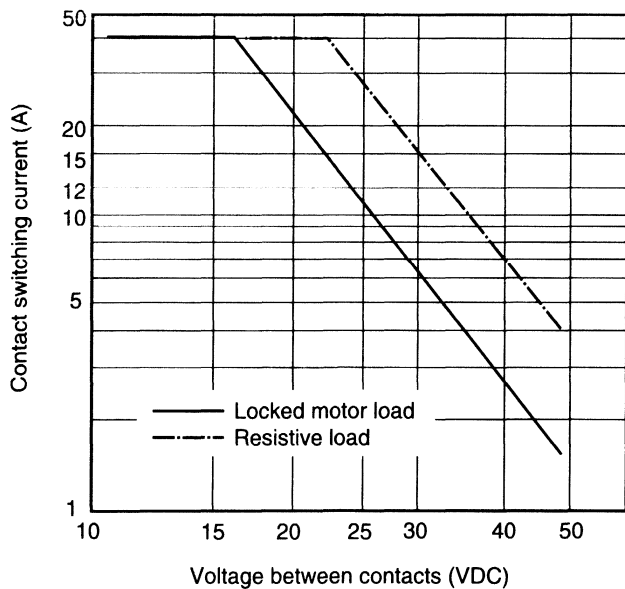
FBR562 SERIES

■ SUITABLE APPLICATIONS

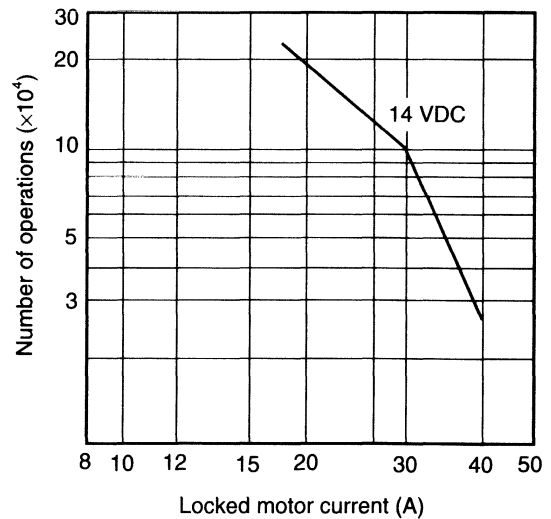
| Application | | Normal load current | Life x 10 ³ | Recommended model (example) |
|------------------|---------------------|---|------------------------|-----------------------------|
| For 12 V battery | Power Windows | 20 to 30 A (switching at motor locking) | 100 | FBR562N□□-W |
| | Automatic Door Lock | 18 to 30 A/4 to 5 door (switching at motor locking) | 100 | FBR562N□□-W |
| | Intermittent Wipers | INRUSH 15 to 30 A BREAK 2 to 8 A (motor free) | 300 | FBR562N□□-N |
| | Tilt-Lock Wheel | INRUSH 15 A BREAK 2.5 A (motor free) | 100 | FBR562N□□-W |
| | Sunroof | 20 to 30 A (switching at motor locking) | 100 | FBR562N□□-W |
| | Others | Car audio system, etc | — | FBR562N□□-W |

■ CHARACTERISTIC DATA

1. MAXIMUM BREAK CAPACITY



2. LIFE

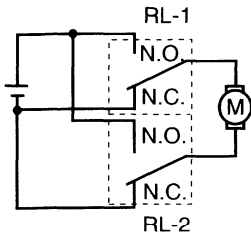


FBR562 SERIES

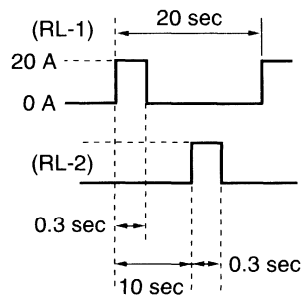
3. LIFE TEST (EXAMPLE)

- Test item
14 VDC-20 A
Motor lock
200,000 operations minimum
(FBR562 □-W type)

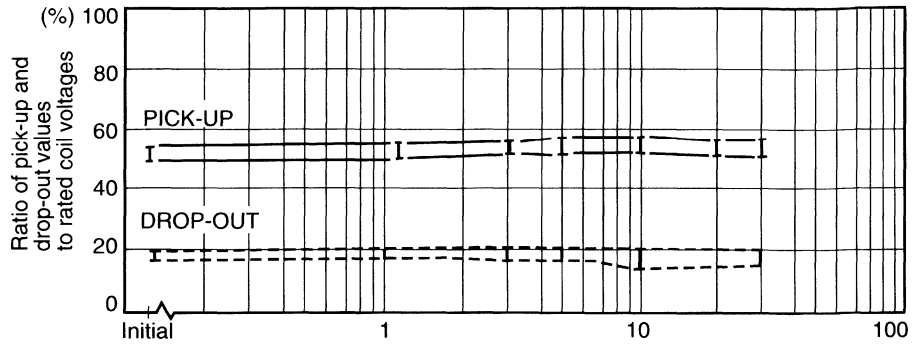
- Test circuit



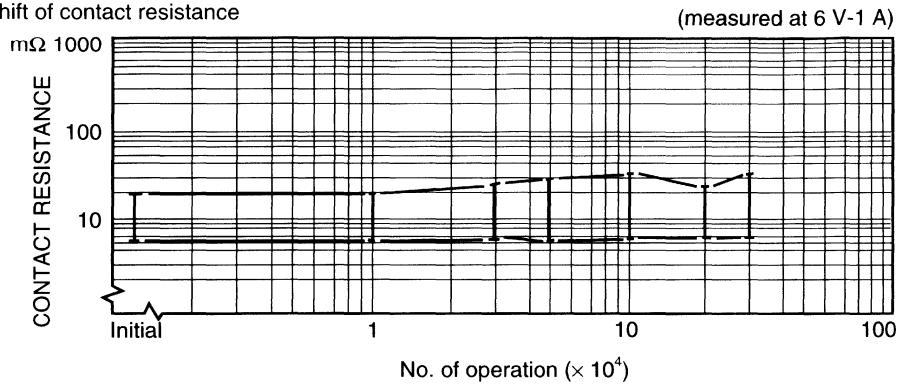
- Current Wave Form



- Shift of pick-up drop-out voltage

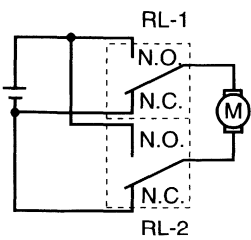


- Shift of contact resistance

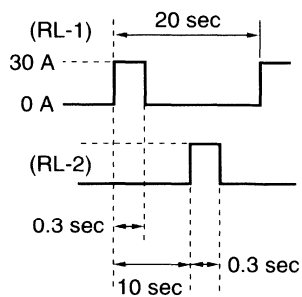


- Test item
14 VDC-30 A
Motor lock
100,000 operations minimum
(FBR562 □-W type)

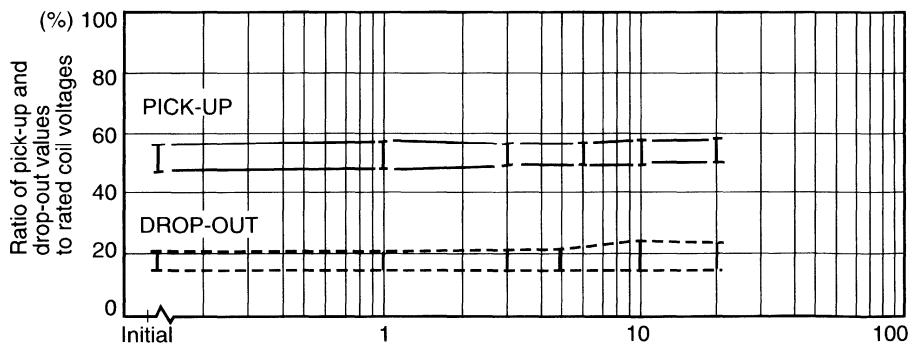
- Test circuit



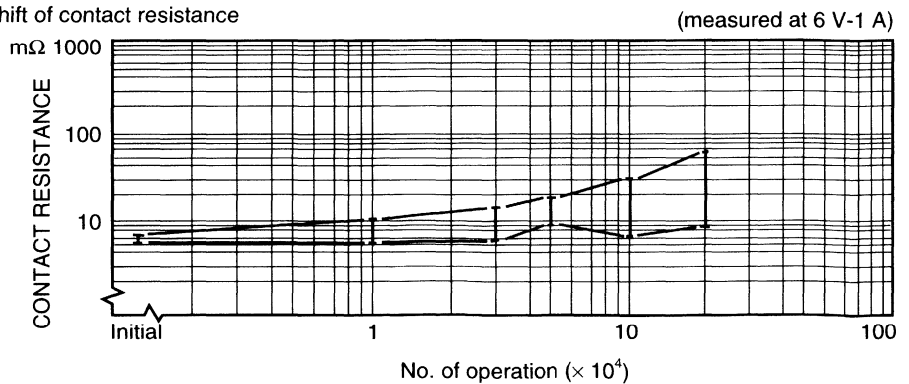
- Current wave form



- Shift of pick-up drop-out voltage



- Shift of contact resistance



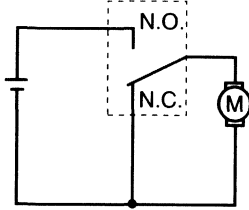
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FBR562 SERIES

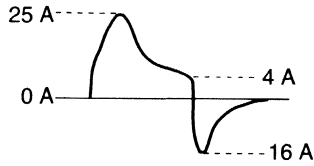
(Continued)

- Test item
16 VDC-25 A INRUSH
Motor Free
400,000 operations minimum
(FBR562 □-N type)

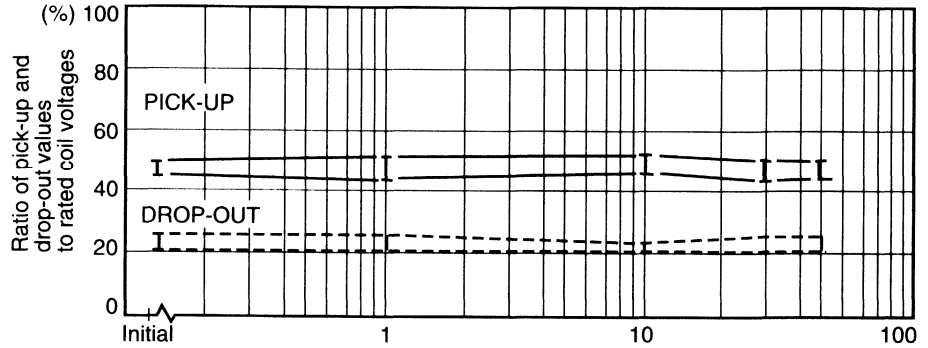
• Test circuit



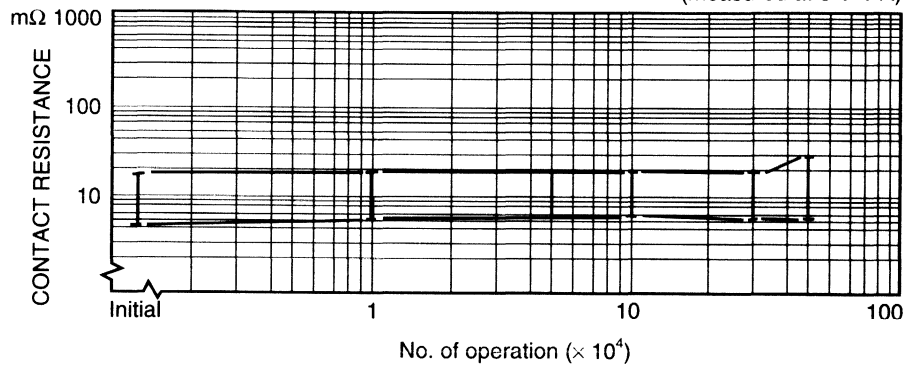
• Current wave form



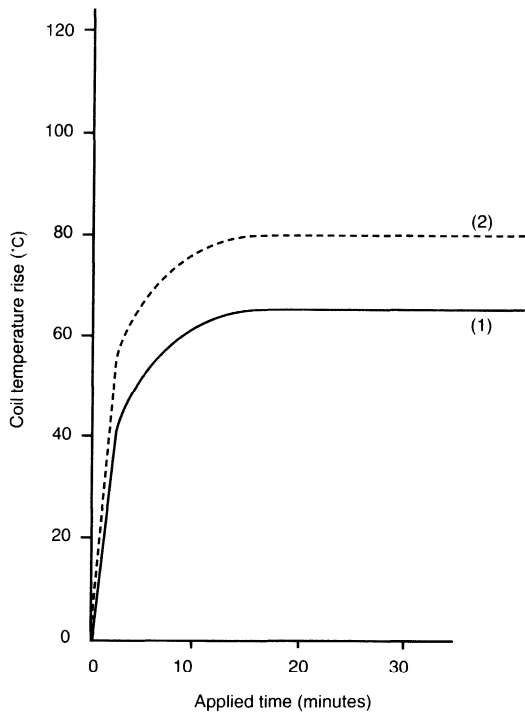
• Shift of pick-up drop-out voltage



• Shift of contact resistance



4. COIL TEMPERATURE RISE

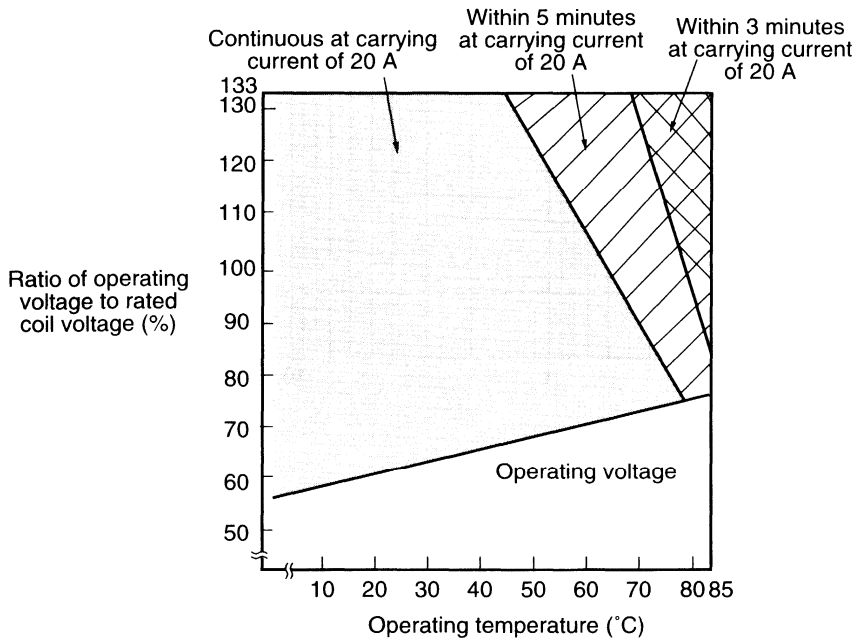


*: One coil energized at 20°C

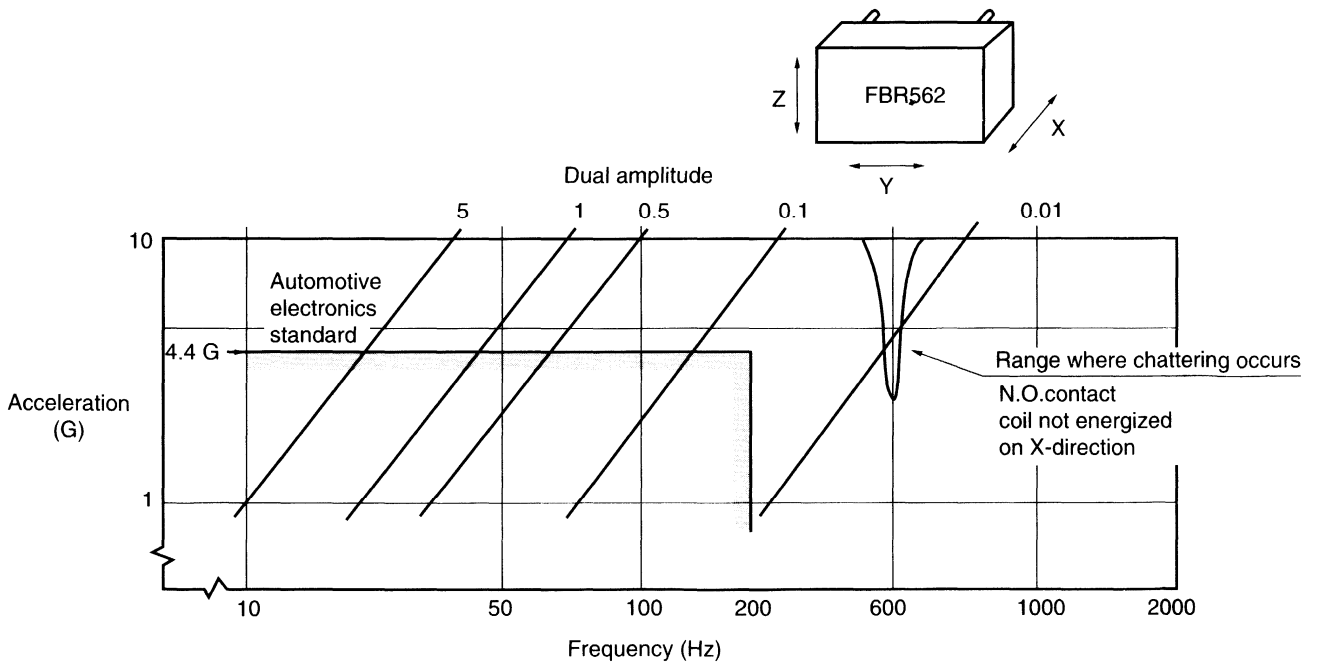
If both coils are energized, temperature rise will increase by
(1) 5°C (0 A carrying current)
(2) 20°C (10 A carrying current)

FBR562 SERIES

5. OPERATING COIL VOLTAGE RANGE (EXAMPLE)

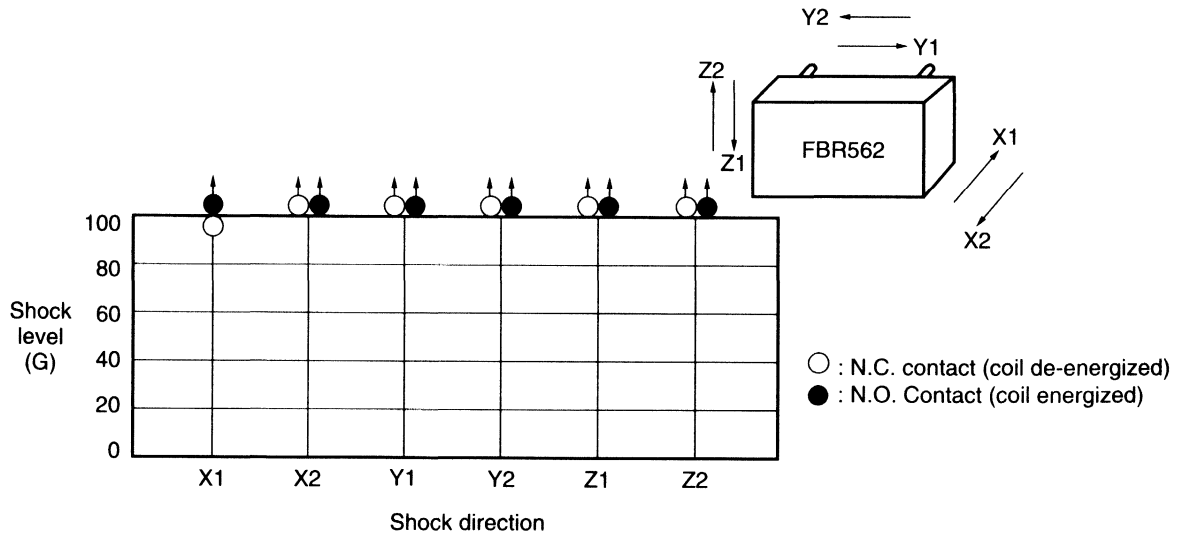


6. VIBRATION RESISTANCE CHARACTERISTICS

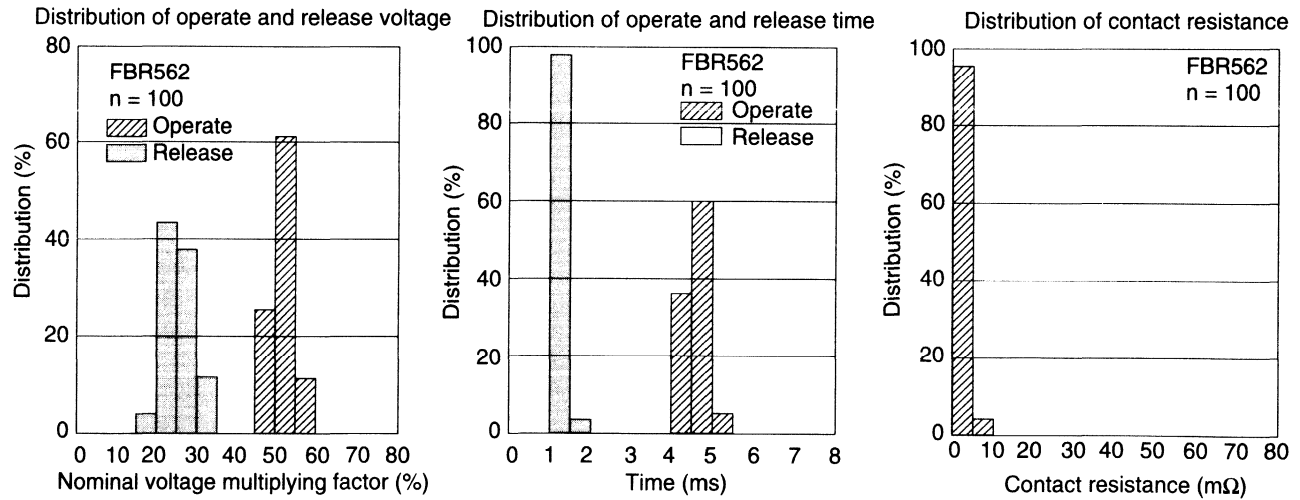


FBR562 SERIES

7. SHOCK RESISTANCE CHARACTERISTICS



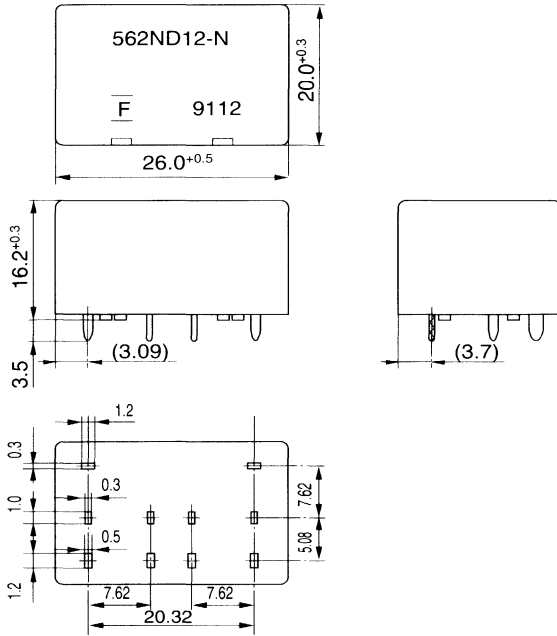
■ REFERENCE DATA



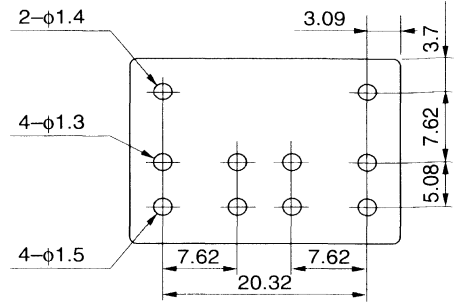
FBR562 SERIES

■ DIMENSIONS

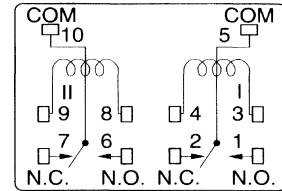
● Dimensions



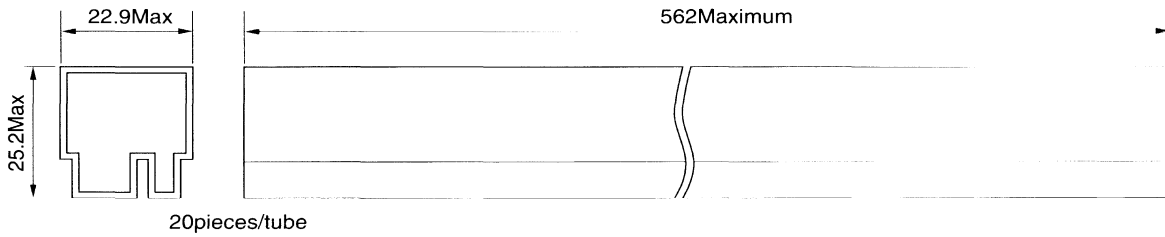
● PC board mounting hole layout (BOTTOM VIEW)



● Schematic (BOTTOM VIEW)



● Tube carrier



Unit: mm

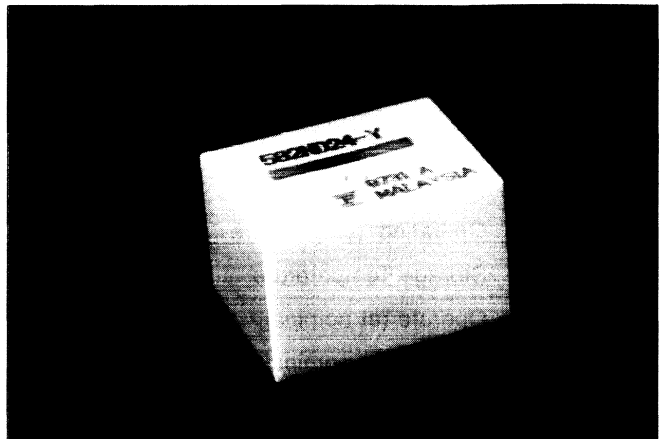
COMPACT POWER RELAY

1 POLE X 2—12A (28VDC)(FOR 24V BATTERY AUTOMOTIVE APPLICATIONS)

FBR572, 582 SERIES

■ FEATURES

- Two independent relays mounted in a single package (43% of the volume of the two FRL-270 relays)
- High current contact capacity (carrying current: 40 A/2 minutes, 30 A/1 hour)
- Suitable for controlling 24 V motors in trucks and other large vehicles
- High heat resistance and extended operating voltage
- Two types of contact gap (FBR572: 0.8 mm, FBR582: 1.4 mm)



■ ORDERING INFORMATION

[Example] FBR572 N D24 - W **
 (a) (b) (c) (d) (e)

| | | |
|-----|--------------------|--|
| (a) | Series Name | FBR572: FBR572 Series relay (contact gap 0.8 mm) FBR582: FBR582 Series relay (contact gap 1.4 mm) |
| (b) | Structure | N : Plastic sealed type |
| (c) | Nominal Voltage | D24 : 24 VDC |
| (d) | Contact Material | W : Silver-tin oxide indium Y : Silver-tin oxide N : Silver copper nickel |
| (e) | Custom Designation | To be assigned custom specification |

FBR572, 582 SERIES

■ SPECIFICATIONS

| Item | | FBR570 Series | FBR580 Series |
|------------|--------------------------------------|--|---|
| Contact | Arrangement | 1 form C x 2 (SPDT x 2) | |
| | Material | Silver-tin oxide indium (-W type) Silver copper nickel (-N type) | Silver-tin oxide indium (-W type) Silver-tin oxide (-Y type) |
| | Voltage Drop (Resistance) | Maximum 100 mV (at 12 VDC 2 A) | |
| | Ratings | 28 VDC 12 A (locked motor load) 28 VDC inrush 15 A, break 2.5 A (motor free load) | |
| | Maximum Carrying Current | 40 A/2 minutes, 30 A/ 1 hour (25°C, 100% rated coil voltage) | |
| | Maximum Inrush Current (Reference) | -W, -Y type: 60 A -N type: 40 A | |
| | Max. Switching Current (Reference) | 12 A 28 VDC | 14 A 32 VDC |
| | Minimum Switching Load*1 (Reference) | -W, -Y Type: 6 VDC 1 A -N Type: 6 VDC 2 A | |
| Coil | Operating Temperature | -40°C to +85°C (no frost) | |
| | Storage Temperature | -40°C to +100°C (no frost) | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | 10 x 10 ⁶ operations minimum |
| | Electrical | 100 x 10 ³ operations minimum (locked motor load) 500 x 10 ³ operations minimum (motor free load) | 100 x 10 ³ operations minimum (locked motor load) |
| Other | Vibration Resistance | | 10 to 55 Hz (double amplitude of 1.5 mm) |
| | Shock Resistance | Misoperation | 100 m/s ² |
| | | Endurance | 1,000 m/s ² |
| | Weight | | Approximately 18 g |

*1 Values when switching a resistive load at normal room temperature and humidity, and in a clean environment. The minimum switching load varies with the switching frequency and operating environment.

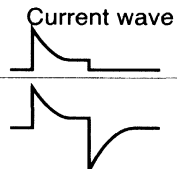
■ COIL DATA CHART

| ORDERING CODE | Rated coil voltage | Coil resistance (±10%) | Must operate voltage | Thermal resistance |
|------------------------------|--------------------|------------------------|----------------------|--------------------|
| FBR572ND24-W FBR572ND24-N | 24 VDC | 384Ω | 14.4 VDC (at 20°C) | 67°C/W |
| FBR582ND24-W FBR582ND24-Y | | 170Ω | 18.0 VDC (at 85°C) | 56°C/W |

FBR572, 582 SERIES

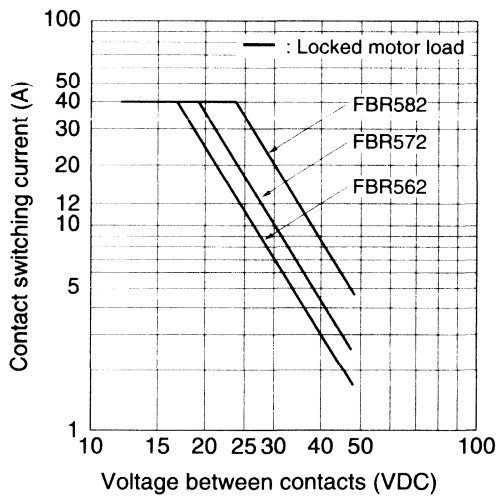
■ SUITABLE APPLICATIONS

| Application | Normal load current | Life x 10 ³ | Recommended model (example) |
|---------------------|---|------------------------|-----------------------------|
| Power Windows | 10 to 12 A (switching at motor locking) | 100 | FBR572ND24-W |
| Automatic Door Lock | 5 A/2 door (switching at motor locking) | 100 | FBR572ND24-W |
| Intermittent Wipers | INRUSH 15 to 30 A BREAK 2 to 8 (motor free) | 300 | FBR572ND24-W |
| | | | FBR572ND24-N |

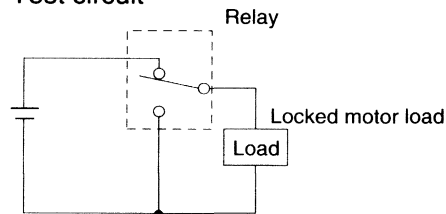


■ CHARACTERISTIC DATA

1. MAXIMUM BREAK CAPACITY



• Test circuit



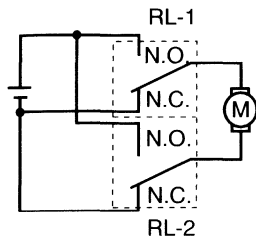
FBR572, 582 SERIES

2. LIFE TEST (EXAMPLE)

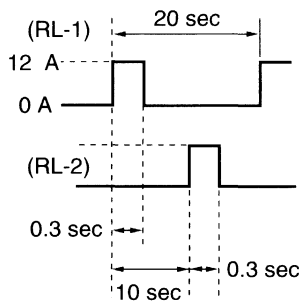
[FBR572 type]

- Test item
28 VDC-12 A
Motor lock
100,000 operations minimum
(FBR572 □-W type)

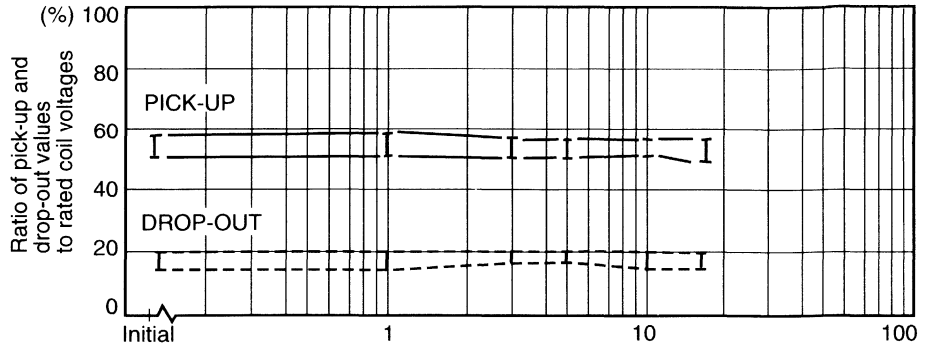
• Test circuit



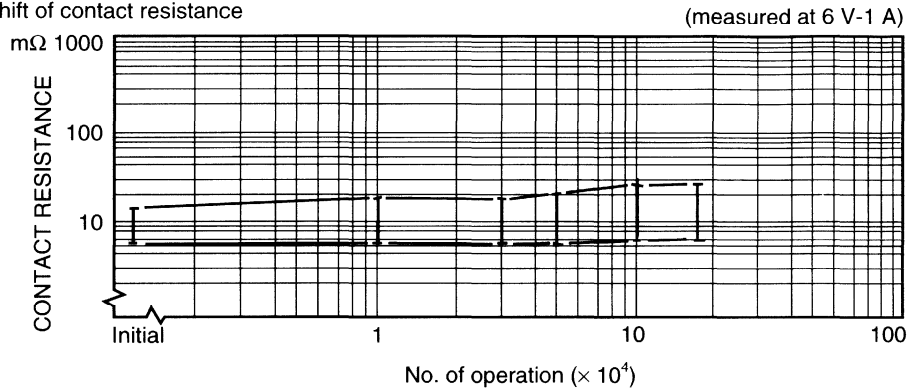
• Current wave form



• Shift of pick-up drop-out voltage



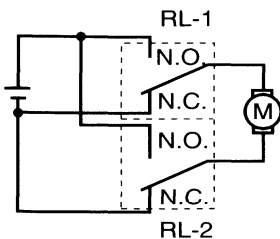
• Shift of contact resistance



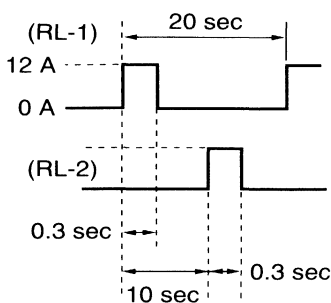
[FBR582 type]

- Test item
28 VDC-12 A
Motor lock
100,000 operations minimum
(FBR582 □-W type)

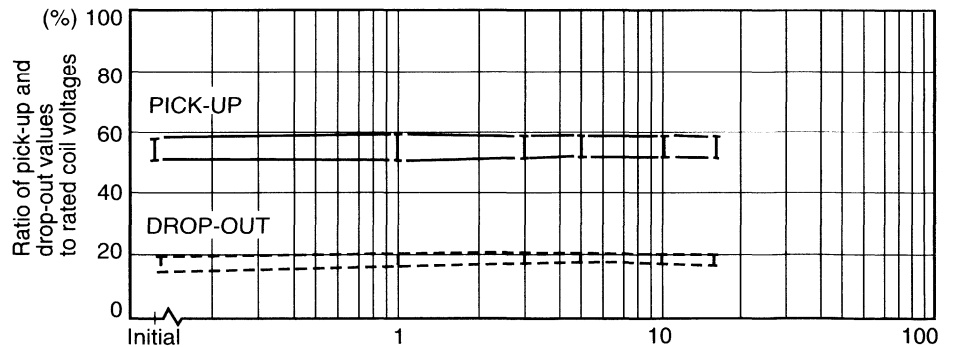
• Test circuit



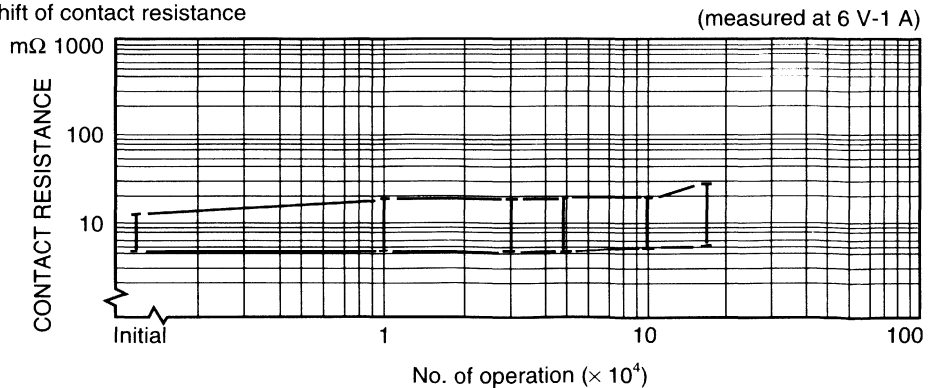
• Current wave form



• Shift of pick-up drop-out voltage



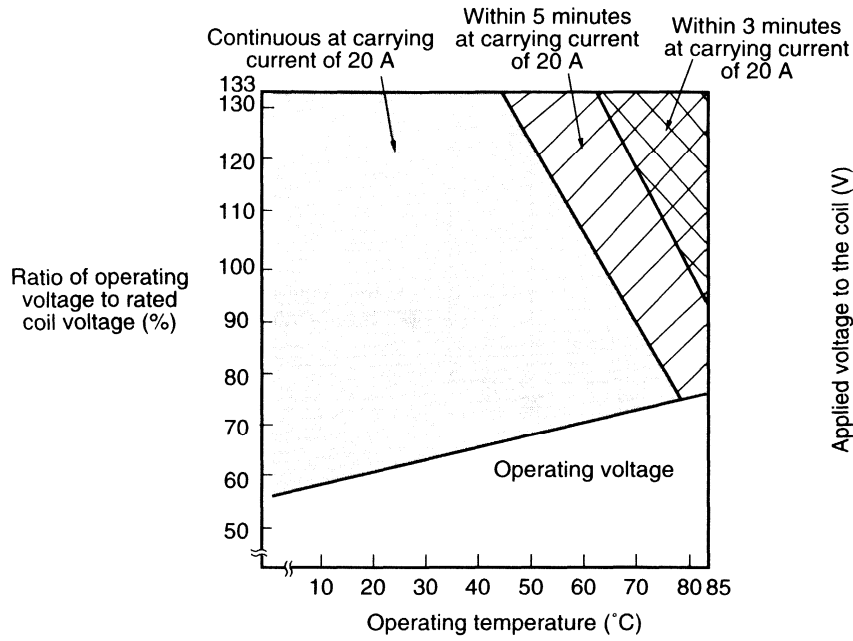
• Shift of contact resistance



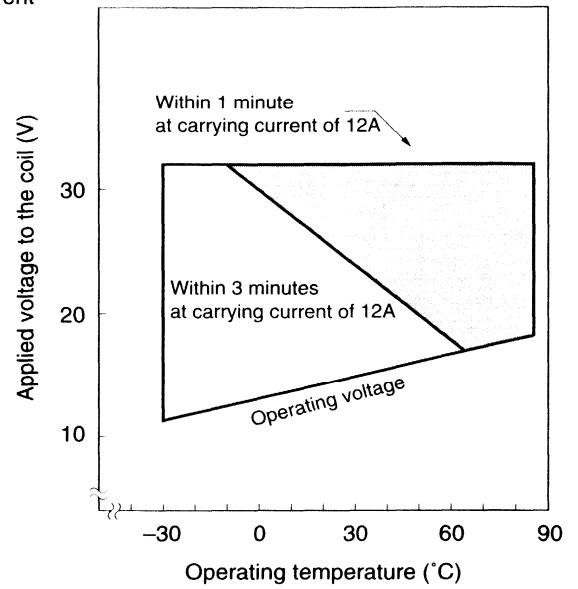
FBR572, 582 SERIES

3. OPERATING COIL VOLTAGE RANGE

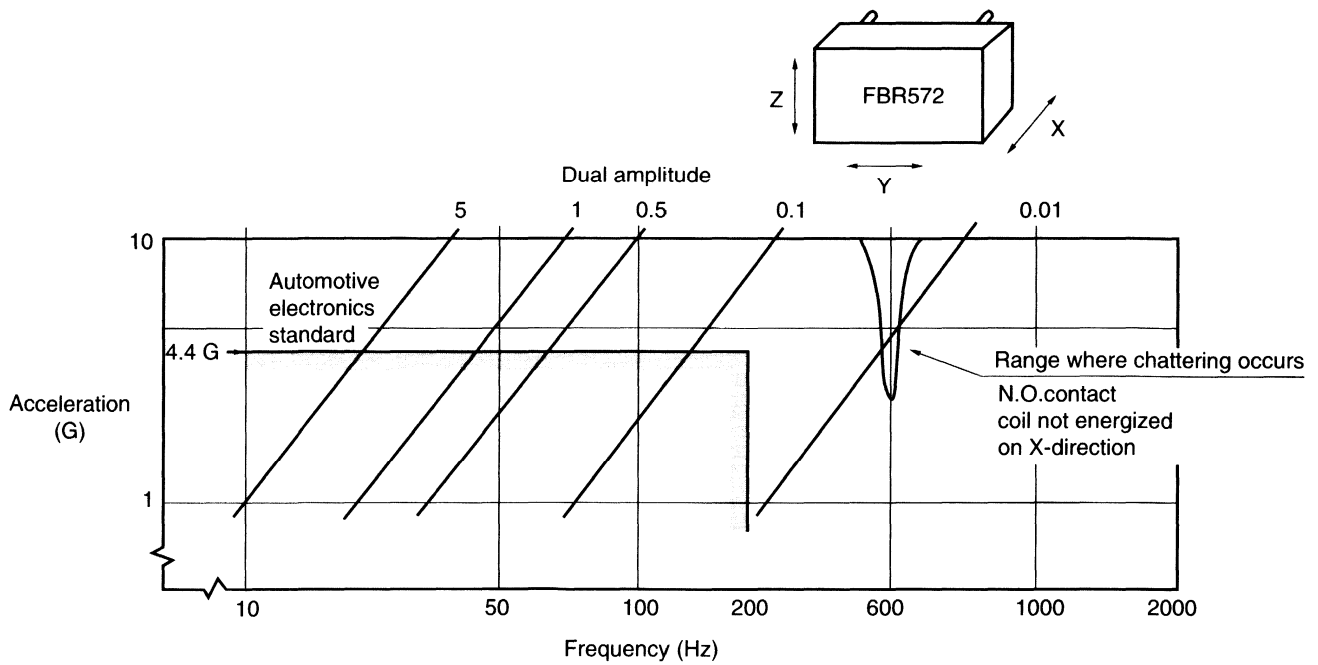
[FBR572 type]



[FBR582 type]

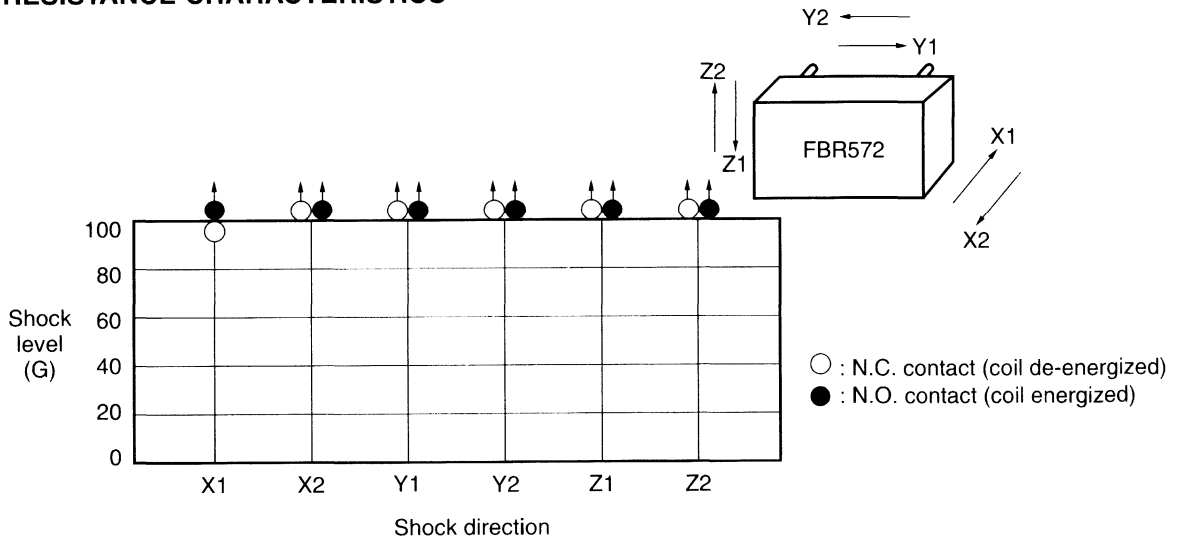


4. VIBRATION RESISTANCE CHARACTERISTICS



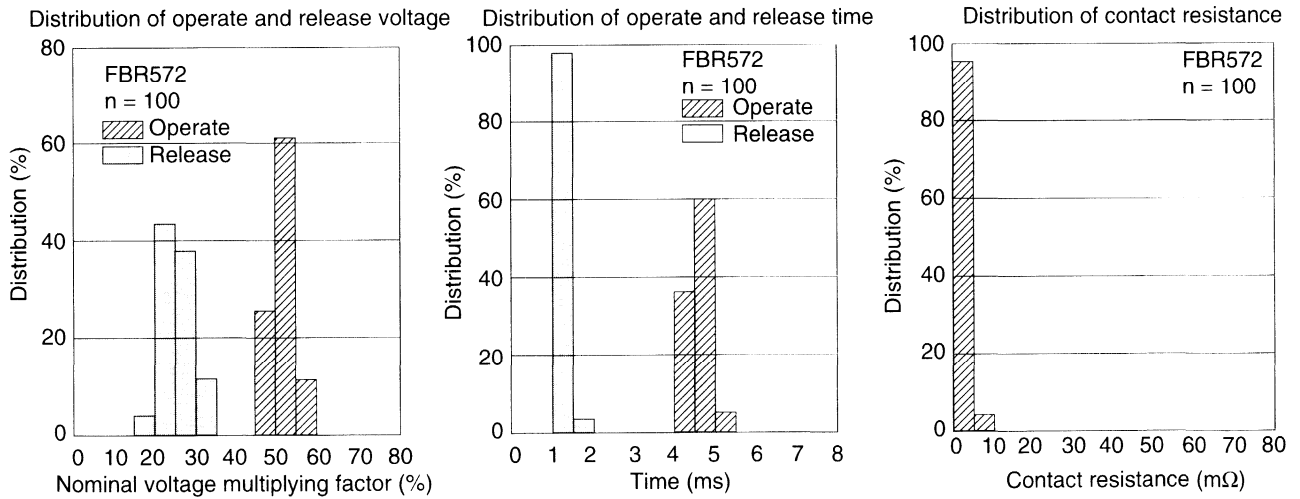
FBR572, 582 SERIES

5. SHOCK RESISTANCE CHARACTERISTICS

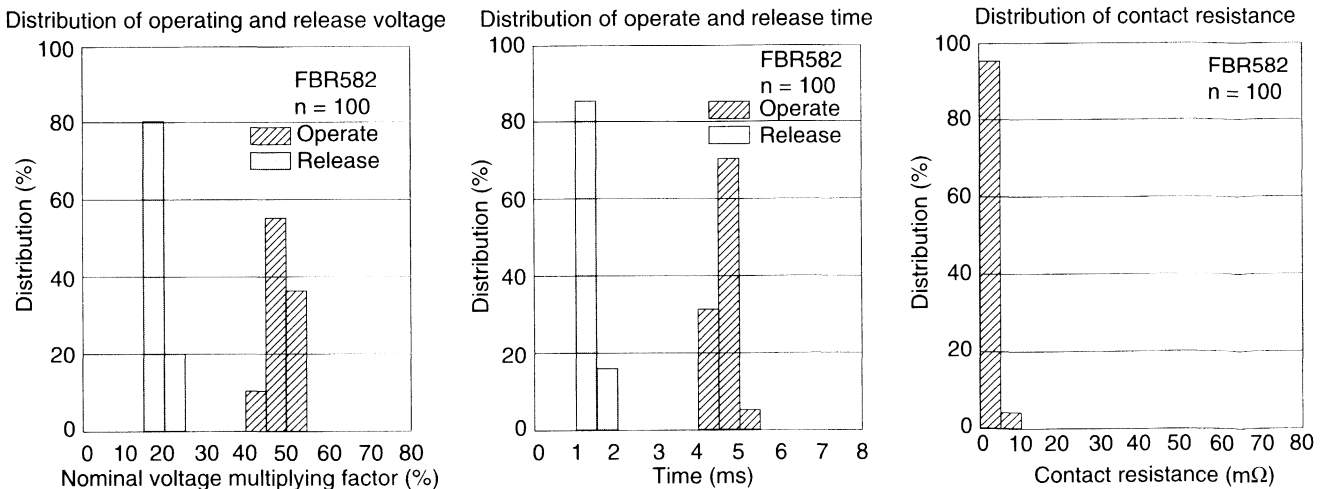


REFERENCE DATA

[FBR572 type]



[FBR582 type]

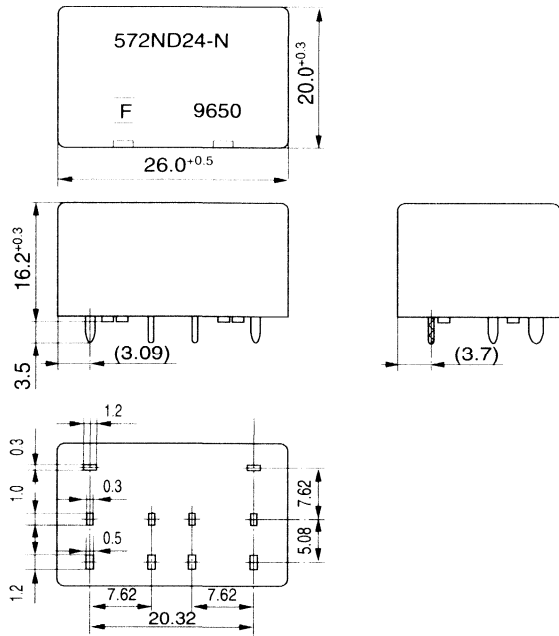


FBR572, 582 SERIES

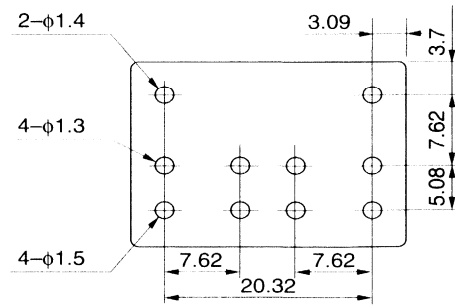
■ DIMENSIONS

[FBR572 type]

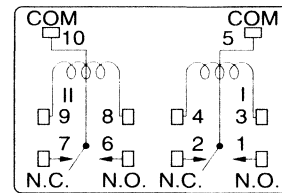
● Dimensions



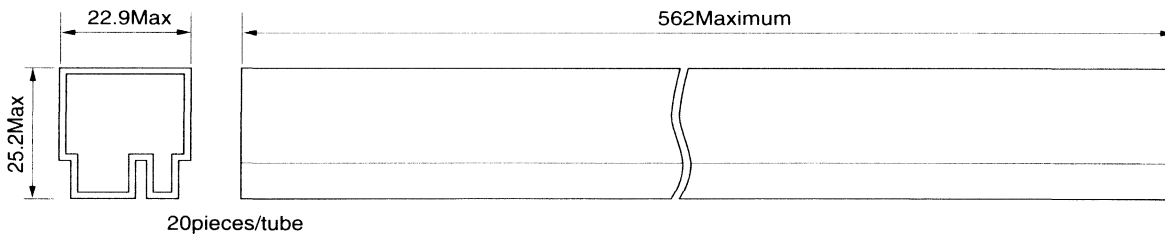
● PC board mounting hole layout (BOTTOM VIEW)



● Schematic (BOTTOM VIEW)



● Tube carrier



Unit: mm

FBR572, 582 SERIES

NOTES



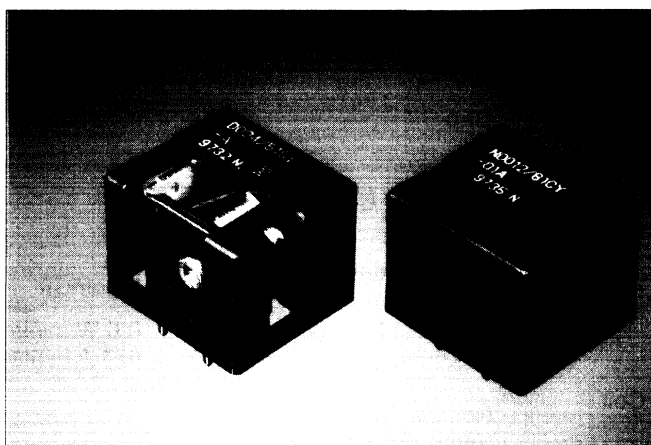
HIGH POWER RELAY

1 POLE—30 A (FOR AUTOMOTIVE APPLICATIONS)

FRL-274 SERIES

■ FEATURES

- Maximum switching current 30 A
- Three types of contact gaps (0.4 mm, 1.0 mm, 1.4 mm)
- Various contact materials
- Immersion cleanable type available
- Tube carrier package



■ ORDERING INFORMATION

[Example] FRL-274 N D 012 / 01 C S - 01A - *** (-S)
 (a) (b) (c) (d) (e) (f) (g) (h) (i) (j)

| | | |
|-----|---------------------|--|
| (a) | Series Name | FRL-274: FRL-274 Series |
| (b) | Enclosure | Nil : Flux free type N : Plastic sealed type |
| (c) | Coil Type | D : Standard (nominal power 1.7 to 2.1 W) H : Low power (nominal power 0.6 W) |
| (d) | Nominal Voltage | (Example) 009 : 9 VDC 012 : 12 VDC 024 : 24 VDC |
| (e) | Contact Gap | 01 : Standard gap (0.4 mm gap) 51 : 1.0 mm gap 61 : 1.4 mm gap |
| (f) | Contact Arrangement | A : 1 form A (SPST-NO) C : 1 form C (SPDT) |
| (g) | Contact Material | S : Silver copper Y : Silver-tin oxide D : Special silver alloy |
| (h) | Cover Terminal | A : w/cover, standard terminal width 01A : w/cover, wide terminal width |
| (i) | Custom Designation | To be assigned custom specification |
| (j) | Package | Nil : Standard tray -S : Carrier tube |

FRL-274 SERIES

■ SPECIFICATIONS

| Item | | Specifications | | | |
|--|--|---|---|----------------------|-------------|
| | | S Contact Material | Y Contact Material | D Contact Material | |
| Contact | Arrangement | 1 form A (SPST-NO), 1 form C (SPDT) | | | |
| | Material | Silver copper | Silver-tin oxide | Special silver alloy | |
| | Voltage Drop (resistance) | Maximum 300 mV initial (at 5 Amps, 12 VDC) Maximum 500 mV after durability test (at 5 Amps, 12 VDC) | | | |
| | Rating | N.O. | 12 VDC 15 A, 24 VDC 10 A | | 12 VDC 30 A |
| | | N.C. | 12 VDC 10 A, 24 VDC 7 A | | |
| | Gap | 01: 0.4 mm gap (standard gap type) 51: 1.0 mm gap 61: 1.4 mm gap | | | |
| | Maximum Carrying Current | 30 A continuous, 40 A/10 minutes (at 25°C 100% rated coil voltage) | | | |
| | Max. Switching Frequency | Electrical | Mechanical: 18,000 operations/hour : 1,800 operations/hour | | |
| Minimum Switching Load ^(*) (reference) | 0.6 W minimum (0.1 A minimum) | 0.6 W minimum (50 mA minimum) | 0.6 W minimum (0.3 A minimum) | | |
| Coil | Nominal Power (rated Voltage at 20°C) | Standard type (D): approximately 1.7 W Low power type (H): approximately 0.6 W 1.4 mm gap type: approximately 2.1 W | | | |
| | Coil Temperature Rise | Standard type (D): approximately 75 °C Low power type (H): approximately 35 °C 1.4 mm gap type: approximately 85 °C (rated voltage at 20°C) | | | |
| | Operating Temperature | -40°C to +85°C (no frost) (refer to the CHARACTERISTIC DATA) | | | |
| | Storage Temperature | -40°C to +100°C (no frost) | | | |
| Insulation | Resistance | Minimum 100 MΩ (at 500 VDC) | | | |
| | Dielectric Strength | AC 500 V 1 minimum | | | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | | | |
| | Release (at nominal voltage) | Standard gap type: maximum 5 ms 1.0 mm gap type: maximum 8 ms 1.4 mm gap type: maximum 10 ms | | | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | | | |
| | Electrical | 250 x 10 ³ operations minimum | | | |
| Other | Vibration Resistance | 10 to 55 Hz (double amplitude of 1.5 mm) | | | |
| | Shock Resistance | Misoperation | 100 m/s ² (11 ± ¹ ms) | | |
| | | Endurance | 1,000 m/s ² (11 ± ¹ ms) | | |
| | Weight | Approximately 20 g | | | |

*1 Values when switching a resistive load at normal room temperature and humidity, and in a clean environment. The minimum applicable load varies with the switching frequency and operating environment.

FRL-274 SERIES

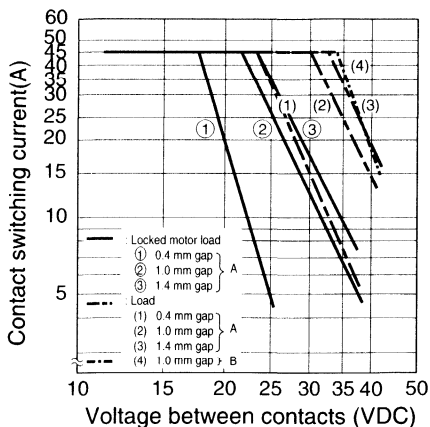
| Features of contact material | Contact material | Symbol | Feature |
|------------------------------|----------------------|--------|---|
| | Silver copper | S | Excellent welding and locking proof against DC load |
| | Silver tin oxide | Y | High durability, long life wiper or lamps |
| | Special silver alloy | D | Durable against high in-rush, for head light or heavy load (30 A) |

COIL DATA CHART

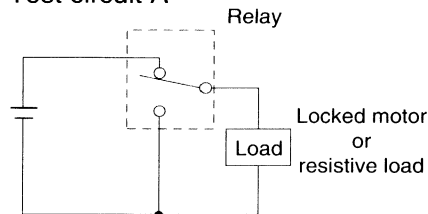
| Type | Nominal voltage | Contact gap | Part number | Coil resistance ($\pm 10\%$) (at 20°C) | Nominal power | Must operate voltage | | Must release voltage | Thermal resistance |
|-----------|-----------------|-------------------|------------------------|--|---------------|----------------------|----------|----------------------|--------------------|
| | | | | | | 20°C | 80°C | | |
| Standard | 6 VDC | 0.4 mm (Standard) | FRL-274 D006/01 - A | 21Ω | 1.7 W | 3.3 VDC | 4.1 VDC | 0.3 VDC | 44°C/W |
| | | 1 mm | FRL-274 D006/51 - A | 21Ω | 1.7 W | 4.2 VDC | 5.2 VDC | 0.3 VDC | |
| | 12 VDC | 0.4 mm (Standard) | FRL-274 D012/01 - A | 85Ω | 1.7 W | 6.5 VDC | 8.0 VDC | 0.6 VDC | |
| | | 1 mm | FRL-274 D012/51 - A | 85Ω | 1.7 W | 8.4 VDC | 10.4 VDC | 0.6 VDC | |
| | 24 VDC | 1 mm | FRL-274 D024/51 - A | 340Ω | 1.7 W | 16.8 VDC | 21.0 VDC | 1.6 VDC | |
| | | 1.4 mm | FRL-274 D024/61 - A | 275Ω | 2.1 W | 16.8 VDC | 21.0 VDC | 1.6 VDC | |
| Low Power | 4 VDC | 0.4 mm (Standard) | FRL-274 H004/01 - A | 27Ω | 0.6 W | 3.0 VDC | 3.7 VDC | 0.2 VDC | 58°C/W |
| | 6 VDC | | FRL-274 H006/01 - A | 60Ω | 0.6 W | 4.2 VDC | 5.2 VDC | 0.3 VDC | |
| | 9 VDC | | FRL-274 H009/01 - A | 135Ω | 0.6 W | 6.3 VDC | 7.8 VDC | 0.5 VDC | |
| | 10 VDC | | FRL-274 H010/01 - A | 165Ω | 0.6 W | 7.0 VDC | 8.7 VDC | 0.6 VDC | |
| | 12 VDC | | FRL-274 H012/01 - A | 240Ω | 0.6 W | 8.4 VDC | 10.4 VDC | 0.8 VDC | |

CHARACTERISTIC DATA

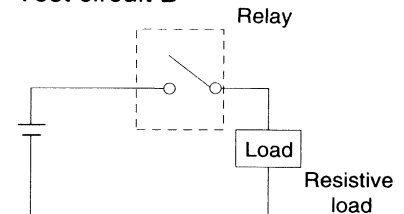
1. MAXIMUM BREAK CAPACITY



Test circuit A

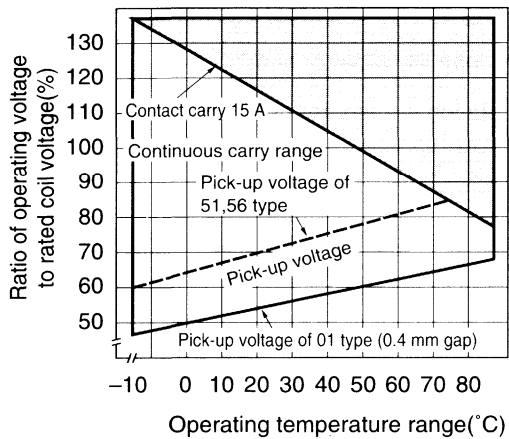


Test circuit B

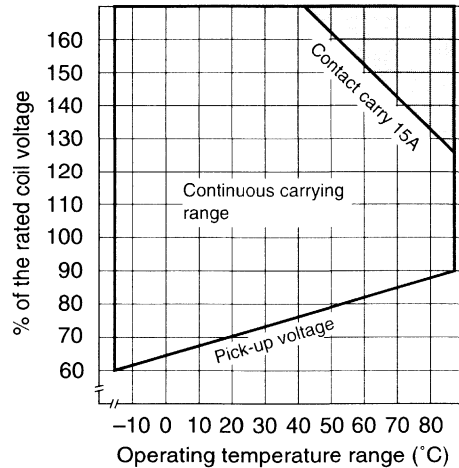


FRL-274 SERIES

2. OPERATING COIL VOLTAGE (EXAMPLE) [Standard (D type)]



[Low power (H type)]

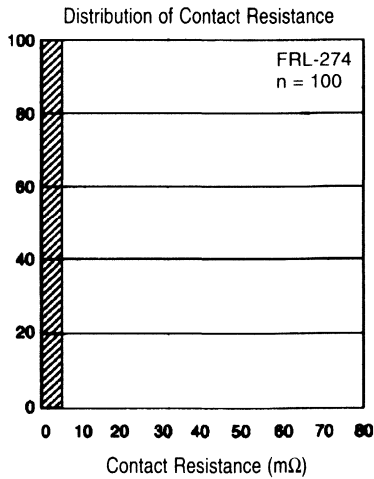
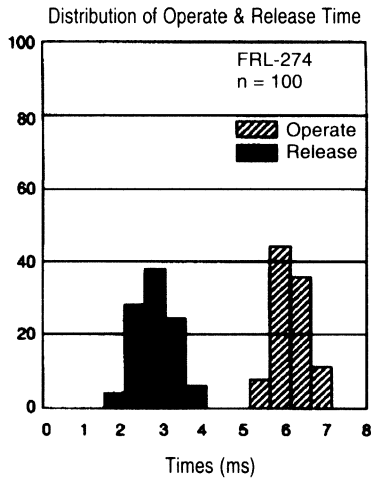
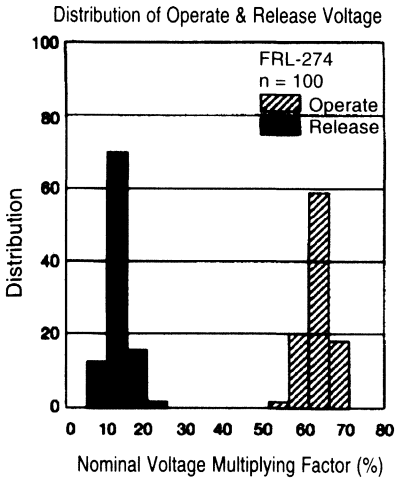


3. LIFE TEST (EXAMPLE)

| Test Item | Test circuit |
|---|--------------|
| <p>N.O DC 14 V-65 W × 2 N.C. DC 14 V-60 W × 2 Halogen lamp load 500,000 operations minimum (contact material: special silver alloy)</p> | |
| <p>DC 14 V-30 A Motor lock 100,000 operations minimum (contact material: silver copper)</p> | |
| <p>DC 30 V-1.6 A Motor free 200,000 operations minimum (contact material: silver copper)</p> | |

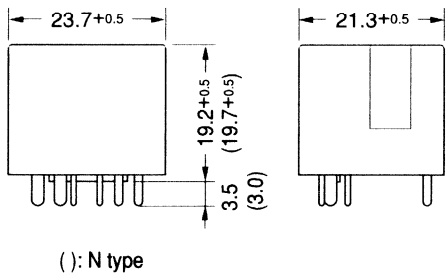
FRL-274 SERIES

REFERENCE DATA

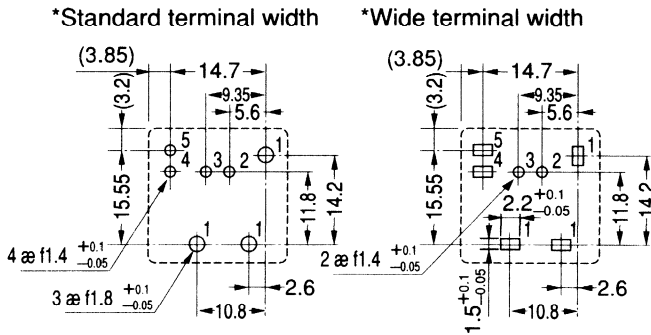


DIMENSIONS

Dimensions



PC board mounting hole layout (BOTTOM VIEW)

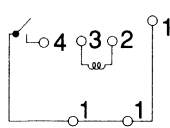
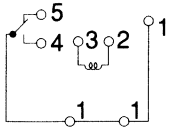


Note : Tolerance 0.1 mm

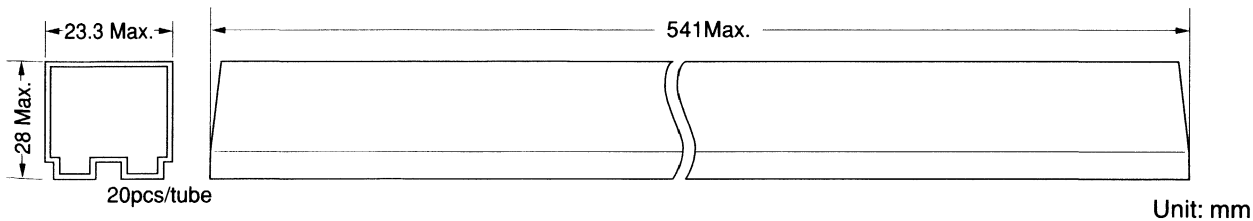
Schematics (BOTTOM VIEW)

• 1 from C

• 1 from A



Tube carrier



FRL-274 SERIES

NOTES

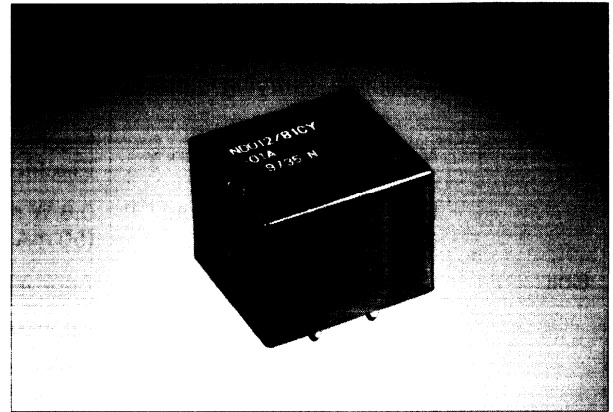


HIGH POWER RELAY

1 POLE—40 A (FOR AUTOMOTIVE APPLICATIONS) FRL-274 (40A TYPE) SERIES

■ FEATURES

- High current switching and carry by using new conductive materials.
- Suitable for automotive applications such as ABS, power assisted steering, etc.
- High heat resistance
Designed for use in high ambient temperature, such as engine compartment, and able to carry continuous current of 20 A in +125°C.
- New contact material
New contact material formulation which is resistant to welding.



■ ORDERING INFORMATION

[Example] FRL-274 N D012 / 81 C Y -01A -001
 (a) (b) (c) (d) (e) (f) (g) (h)

| | | |
|-----|---------------------|-------------------------------------|
| (a) | Series Name | FRL-274: FRL-274 Series |
| (b) | Enclosure | N : Plastic sealed type |
| (c) | Nominal Voltage | D012 : 12 VDC |
| (d) | Carrying Current | 81 : 40 A type |
| (e) | Contact Arrangement | A : 1 form A C : 1 form C |
| (f) | Contact Material | Y : Silver-tin oxide |
| (g) | Cover Terminal | 01A : w/cover, wide terminal width |
| (h) | Custom Designation | To be assigned custom specification |

FRL-274 (40A TYPE) SERIES

■ SPECIFICATIONS

| Item | | Specifications | |
|------------|---|---|------------------------------|
| Contact | Arrangement | 1 form A , 1 form C | |
| | Material | Silver-tin oxide | |
| | Voltage Drop (resistance) | Maximum 300 mV initial (at 5 Amps, 12 VDC) Maximum 500 mV after durability test (at 5 Amps, 12 VDC) | |
| | Rating | N.O. | 12 VDC 40 A (resistive load) |
| | | N.C. | 12 VDC 15 A (resistive load) |
| | Gap | 0.4 mm gap | |
| | Maximum Carrying Current | 30 A continuous, 40 A/10 minutes (at 25°C 100% rated coil voltage) 20 A continuous, 40 A/10 minutes (at 125°C 100% rated coil voltage) | |
| | Max. Switching Frequency | Mechanical: 18,000 operations/hour Electrical: 1,800 operations/hour | |
| | Minimum Switching Load ^(*1) (reference) | 0.6 W minimum (50 mA minimum) | |
| Coil | Power Consumption | Approximately 0.87 W (rated voltage at 20°C) | |
| | Coil Temperature Rise | Approximately 75 °C. (rated voltage at 20°C) | |
| | Operating Temperature | -40°C to +125°C (no frost) | |
| | Storage Temperature | -40°C to +125°C (no frost) | |
| Insulation | Resistance | Minimum 100 MΩ (at 500 VDC) | |
| | Dielectric Strength | AC 500 V 1 minimum | |
| Time Value | Operate (at nominal voltage) | Maximum 10 ms | |
| | Release (at nominal voltage) | Maximum 5 ms | |
| Life | Mechanical | 10 x 10 ⁶ operations minimum | |
| | Electrical | 250 x 10 ³ operations minimum | |
| Other | Vibration Resistance | 10 to 55 Hz (double amplitude of 1.5 mm) | |
| | Shock Resistance | Misoperation | 100 m/s ² |
| | | Endurance | 1,000 m/s ² |
| | Weight | Approximately 20 g | |

*1 Values when switching a resistive load at normal room temperature and humidity and in a clean environment. The minimum applicable load varies with the switching frequency and operating environment.

FRL-274 (40A TYPE) SERIES

COIL DATA CHART

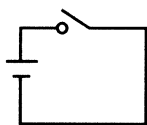
| MODEL | Nominal voltage | Coil resistance ($\pm 10\%$) (at 20°C) | Must operate voltage | Thermal resistance |
|--|-----------------|--|--|--------------------|
| FRL-274ND012/81AY-01A FRL-274ND012/81CY-01A | 12 VDC | 165Ω | 6.3 VDC (at 20°C) 8.0 VDC (at 85°C) | 73°C/W |

CHARACTERISTIC DATA

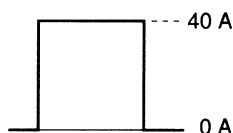
1. LIFE TEST (EXAMPLE)

- Test item
16 VDC, 40 A
Motor lock
 200×10^3 operations

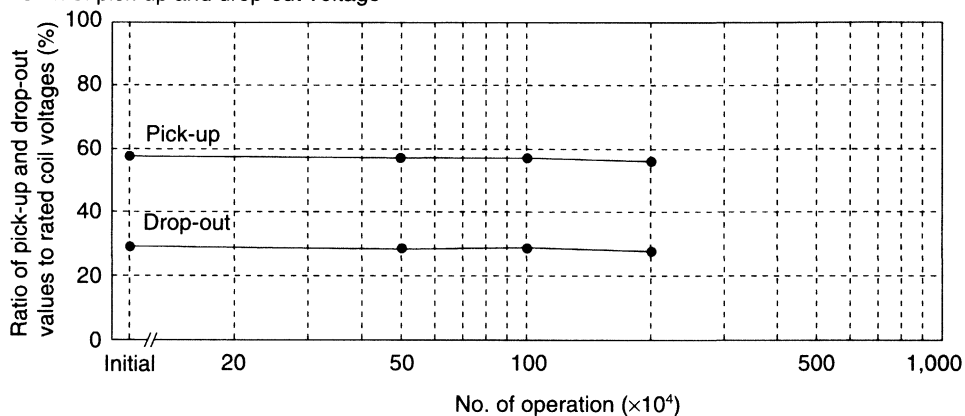
- Test circuit



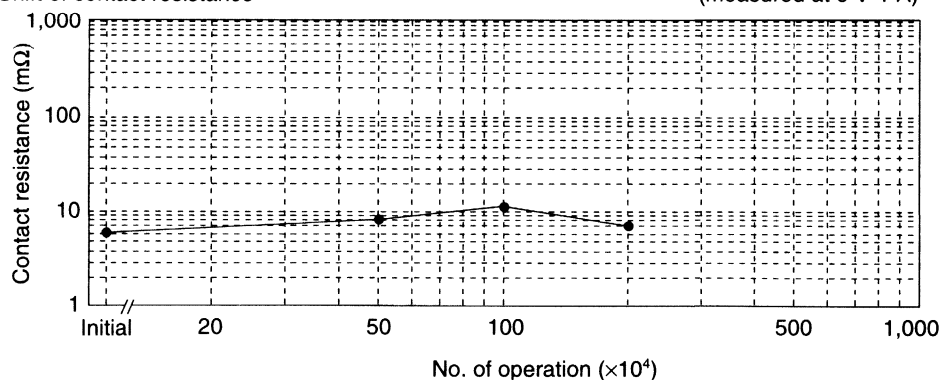
- Circuit wave form



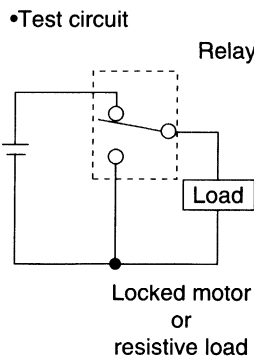
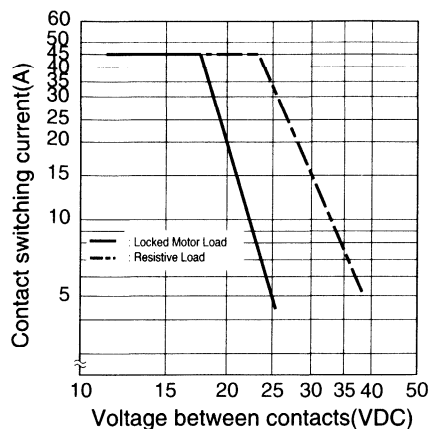
- Shift of pick-up and drop-out voltage



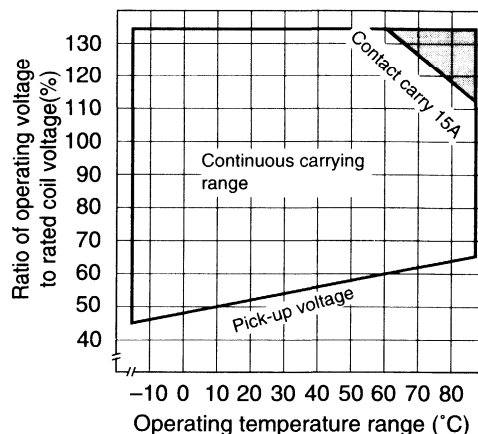
- Shift of contact resistance



2. MAXIMUM BREAK CAPACITY

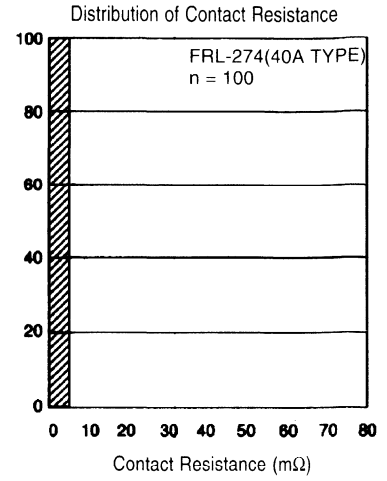
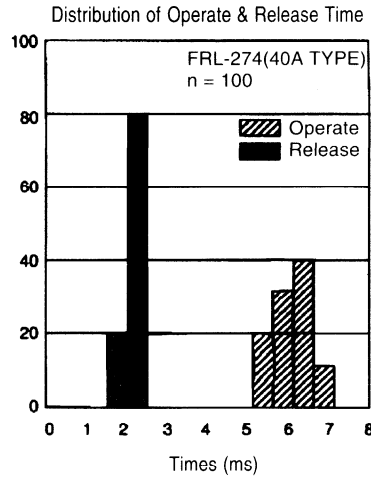
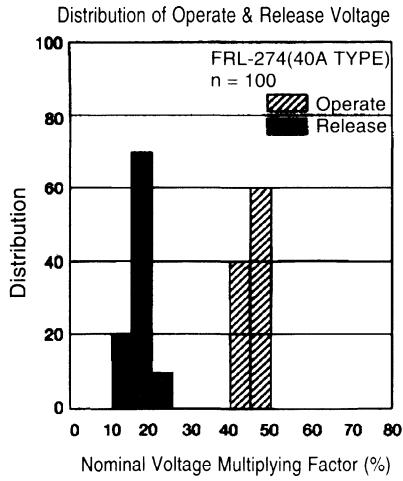


3. OPERATING COIL VOLTAGE (EXAMPLE)



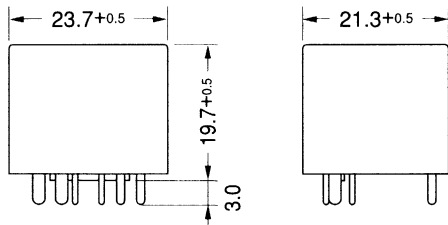
FRL-274 (40A TYPE) SERIES

REFERENCE DATA



DIMENSIONS

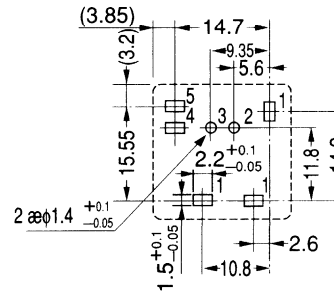
Dimensions



(): N type

PC board mounting hole layout (BOTTOM VIEW)

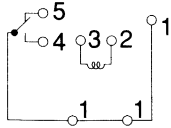
Standard terminal width



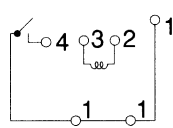
Note : Tolerance 0.1 mm

Schematics (BOTTOM VIEW)

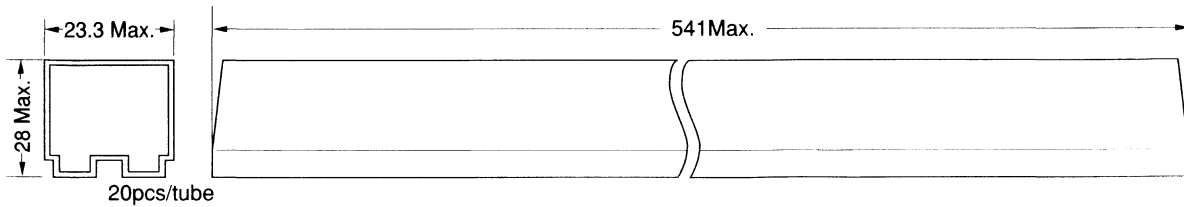
• 1 from C



• 1 from A



Tube carrier



Unit: mm

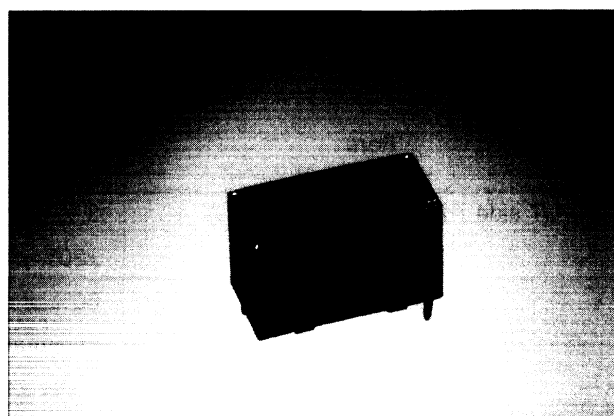
SOLID STATE RELAY

MAXIMUM LOAD CURRENT 1 A

SJ SERIES

■ FEATURES

- UL, CSA recognized
- Extremely small and light weight
 - Size: 10.0 (W) x 20.2 (L) x 12.8 (H) mm
 - Weight: approximately 5.5g
- High reliability, long life and maintenance free
- High isolation (between input and output)
 - Dielectric strength: 2,500 Vrms
- Compatible with JY Relay in size and terminal arrangement



■ ORDERING INFORMATION

[Example] SJ – 12 D 01 HZ N
 (a) (b) (c) (d) (e) (f)

| | | |
|-----|---|---|
| (a) | Series Name | SJ : SJ Series |
| (b) | Nominal Voltage (Input side) | 3 : 3 VDC (only AC type) 5 : 5 VDC 12 : 12 VDC 24 : 24 VDC |
| (c) | Load Voltage | A : AC type D : DC type |
| (d) | Load Current | 01 : 1 A |
| (e) | Kinds of Inverse Connection Protecting Element (only DC type) | Nil : Diode HZ : Zener diode type |
| (f) | Terminal Classification | Nil : Socket mounting N : PC Board mounting type |

SJ SERIES

■ SAFETY STANDARD AND FILE NUMBERS

UL508 (File No. E45026)

C22.2 No. 0, No.14 (File No. LR35579)

Please request when the approval markings are required on the cover

| Type | INPUT Nominal Voltage | OUTPUT Load Voltage |
|------------|-----------------------|-----------------------|
| SJ-() A01 | 5 VDC to 24 VDC | 1 A 265 VAC resistive |
| SJ-() D01 | 5 VDC to 24 VDC | 1 A 30 VDC resistive |

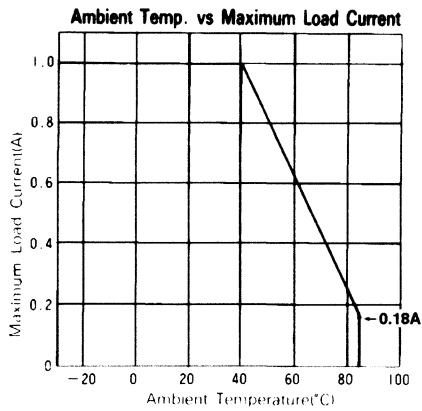
■ SPECIFICATIONS

| Item | | AC | DC | Remarks |
|-----------------------------|--------------------------------|--|--------------------|-------------------------|
| | | TYPE 1A | TYPE 1A | |
| INPUT side | Nominal Voltage (DC) | 3 V, 5 V, 12 V, 24 V | 5 V, 12 V, 24 V | |
| | Operate Range | ±20% of nominal voltage | | |
| | Must Operate Voltage | 80% of nominal voltage | | |
| | Must Release Voltage | Minimum 1 V (minimum 0.5 V*) | | *3 VDC type |
| | Input Impedance | 3 VDC Type | 120Ω ±10% | — |
| 5 VDC Type | | 360Ω ±1V | 430Ω ±10% | |
| 12 VDC Type | | 1.0 kΩ ±10% | 1.2 kΩ ±10% | |
| 24 VDC Type | | 2.0 kΩ ±10% | 2.4 kΩ ±10% | |
| OUTPUT side | Load Voltage Range | 24 to 265 Vrms | 3 to 30 VDC | see CHARACTERISTIC DATA |
| | Maximum Load Current | 1.0 Arms | 1.0 A | |
| | Minimum Load Current | 10 mArms | 1 mA | |
| | 1 Cycle Surge Current | 50 A (60 Hz) | 3 A (10 ms) | |
| | Max. Off-state Leakage Current | 0.75 mArms (at 100 Vrms 60 Hz) 1.50 mArms (at 200 Vrms 60 Hz) | 0.1 mA (at 30 VDC) | |
| | Max. Off-state Voltage Drop | 1.2 Vrms | 1.2 V | at max. load current |
| Max. Operate Time | | 1 ms | | |
| Max. Release Time | | 1/2 cycle + 1 ms | 1 ms | |
| Insulation Resistance | | Minimum 1,000 MΩ (at 500 VDC) | | for input-output |
| Dielectric Strength | | 2,500 Vrms for 1 minute | | for input-output |
| Operating Temperature Range | | -30°C to + 85°C | | |
| Storage Temperature Range | | -40°C to + 100°C | | |
| Case Color | | Black | Green | |
| Weight | | Approximately 5.5 g | | |

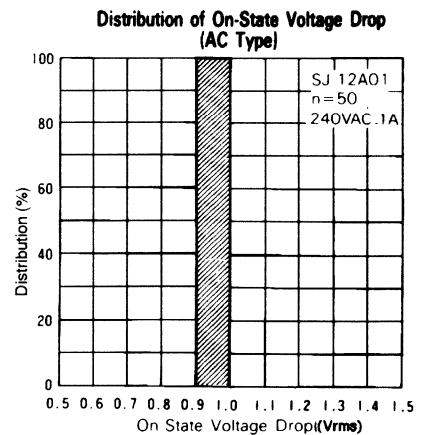
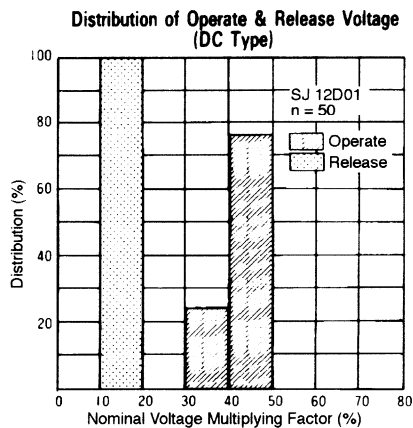
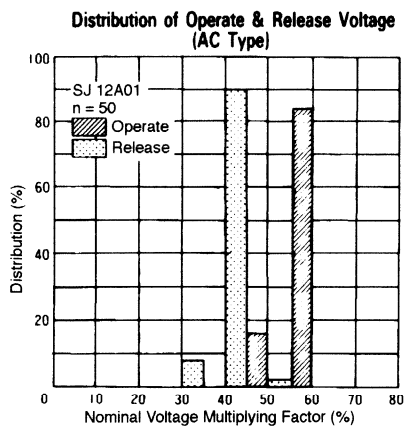
■ BLOCK DIAGRAM

| LOAD | INSULATION | CIRCUITS | Input/Output waveform (resistive load) |
|------|--------------------------|----------|--|
| AC | Photo-triac coupler | | |
| DC | Photo-transistor coupler | | |

■ CHARACTERISTIC DATA

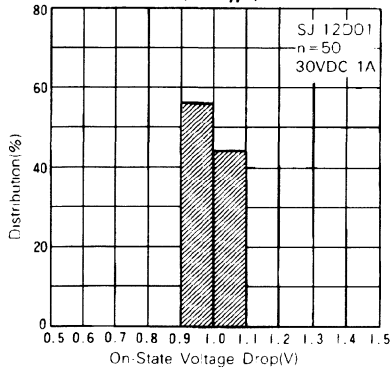


■ REFERENCE DATA

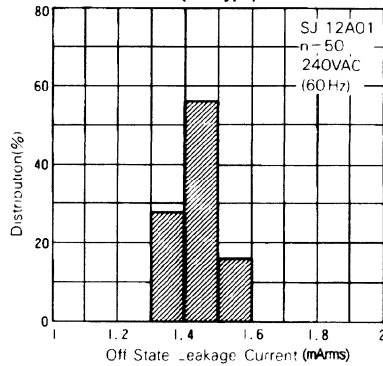


SJ SERIES

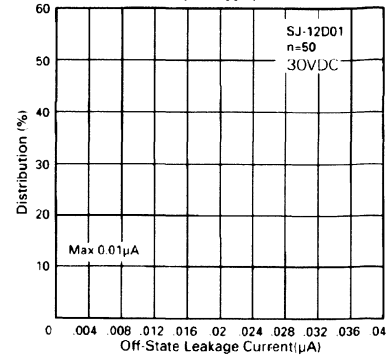
Distribution of On-State Voltage Drop (DC Type)



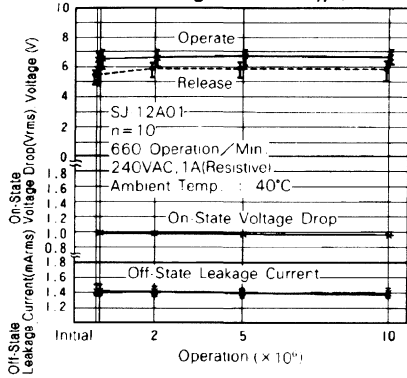
Distribution of Off-State Leakage Current (AC Type)



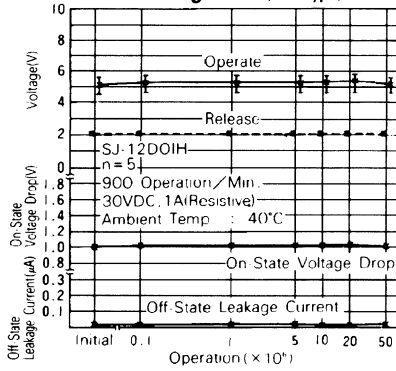
Distribution of Off-State Leakage Current (DC Type)



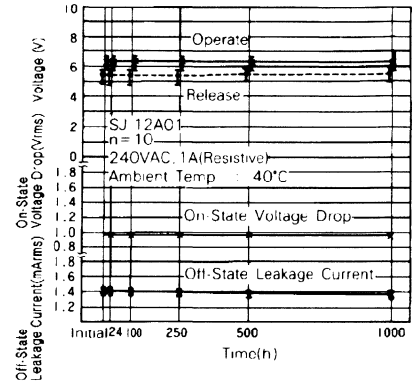
Switching Test (AC Type)



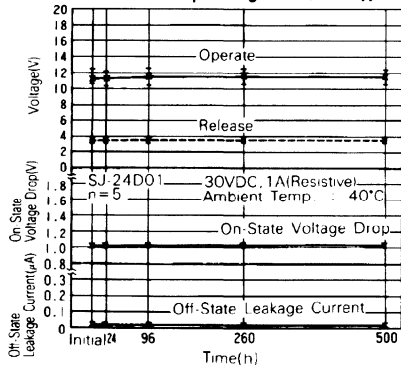
Switching Test (DC Type)



Continuous Operating Test (AC Type)



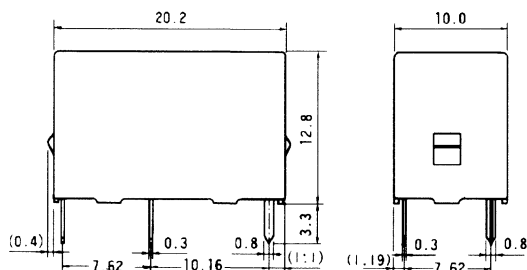
Continuous Operating Test (DC Type)



DIMENSIONS

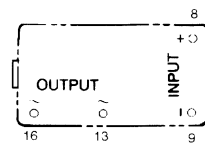
● Dimensions

SJ-()A Type



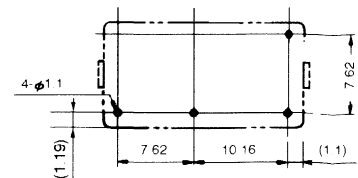
● Schematics

(BOTTOM VIEW)



● PC board mounting hole layout

(BOTTOM VIEW)

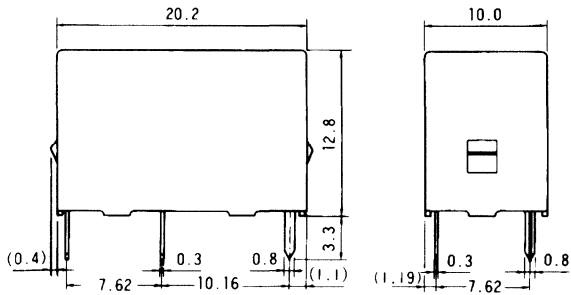


Unit: mm

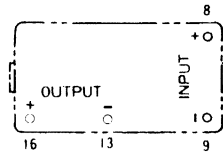
SJ SERIES

● Dimensions

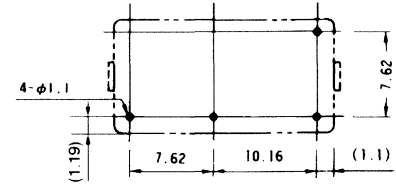
SJ-()D type



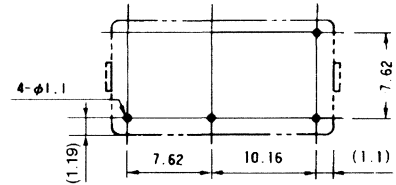
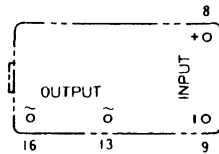
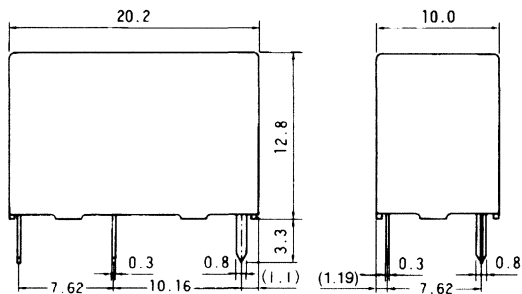
● Schematics (BOTTOM VIEW)



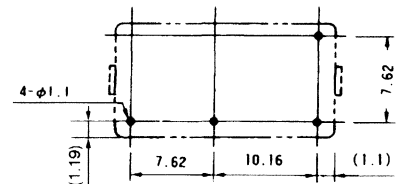
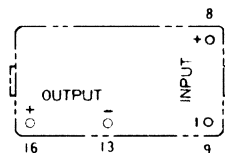
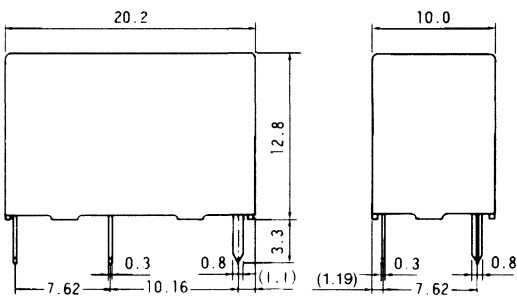
● PC board mounting hole layout (BOTTOM VIEW)



SJ-()AN type

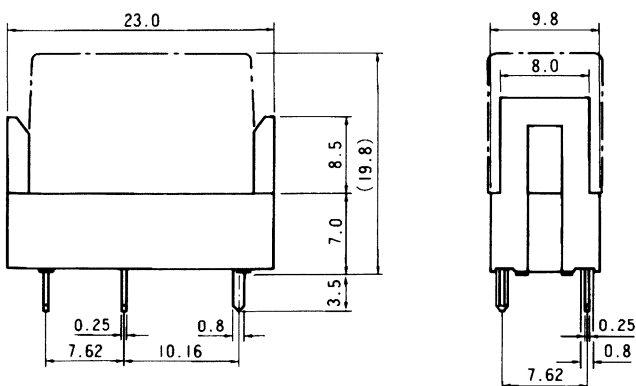


SJ-()DN type



Unit: mm

■ SOCKET DIMENSIONS



Unit: mm

■ NOTES

1. Polarity of terminals are pre-determined. Please design your circuit accordingly.
2. Socket ordering code: JK-4N
3. Standard IC socket is not recommended. Please use socket "JK-4N"

SJ SERIES

NOTES



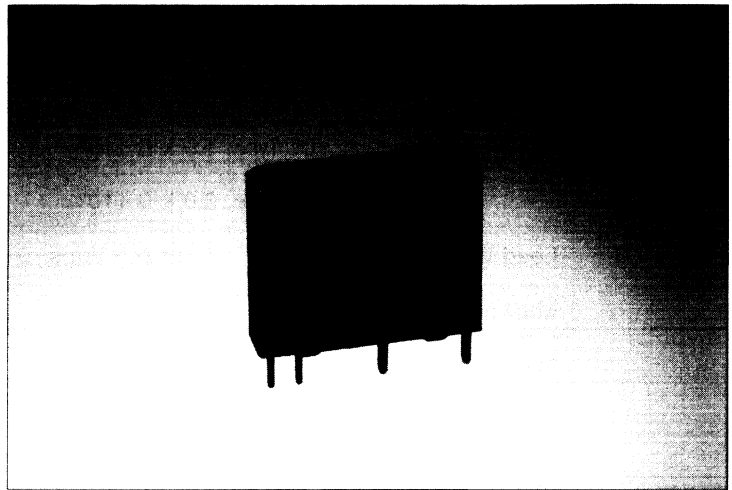
SOLID STATE RELAY

MAXIMUM LOAD CURRENT 1.5 A

SE SERIES

■ FEATURES

- Conforms to UL, CSA standards
- Ultra slim and light weight, SIL terminals type
 - Size: 5.0 (W) x 20.0 (L) x 17.0 (H)mm
 - Weight: approximately 4.0 g
- High reliability, long life and maintenance free
- High isolation (between input and output)
 - Dielectric strength: 2,500 Vrms
- Internal zero cross circuit type available



■ ORDERING INFORMATION

[Example] SE - 12 A 015 C
 (a) (b) (c) (d) (e)

| | | |
|-----|------------------------------|--|
| (a) | Series Name | SE : SE Series |
| (b) | Nominal Voltage (Input side) | 3 : 3 VDC 5 : 5 VDC 12 : 12 VDC 24 : 24 VDC |
| (c) | Load Voltage | A : AC type |
| (d) | Load Current | 015 : 1.5 A |
| (e) | Zero Cross Circuit | Nil : No zero cross type C : Zero cross type |

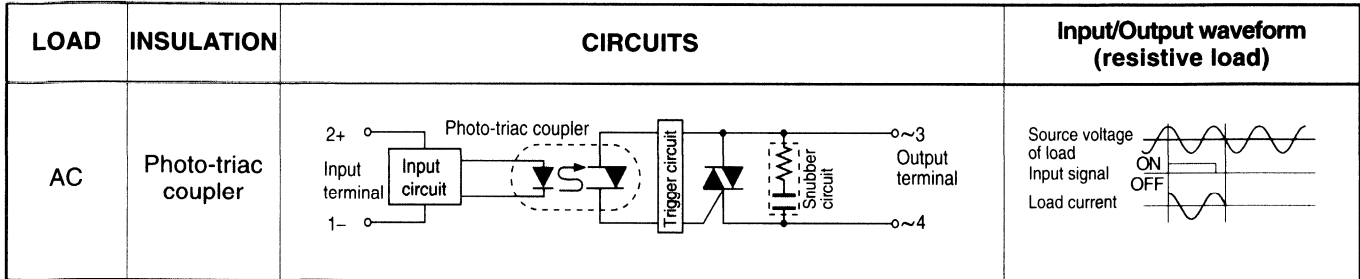
SE SERIES

■ SPECIFICATIONS

| Item | | AC | | Remarks |
|-----------------------------|--------------------------------|--|------------|-------------------------|
| | | Type 1.5 A | | |
| INPUT side | Nominal Voltage (DC) | 3 V, 5 V, 12 V, 24 V | | |
| | Operate Range | ±20% of nominal voltage | | |
| | Must Operate Voltage | 80% of nominal voltage | | |
| | Must Release Voltage | Minimum 1 V (minimum 0.5 V*) | | *3 VDC type |
| | Input Impedance | 3 VDC Type | 180 Ω ±10% | |
| 5 VDC Type | | 470 Ω ±10% | | |
| 12 VDC Type | | 1.5 k Ω ±10% | | |
| 24 VDC Type | | 3.0 k Ω ±10% | | |
| OUTPUT side | Load Voltage Range | 15 to 265 Vrms | | |
| | Maximum Load Current | 1.5 Arms | | see CHARACTERISTIC DATA |
| | Minimum Load Current | 10 mArms | | |
| | 1 Cycle Surge Current | 50 A (60 Hz) | | |
| | Max. Off-State Leakage Current | 0.5 mArms (at 100 Vrms 60 Hz) 1.0 mArms (at 200 Vrms 60 Hz) | | |
| | Max. On-State Voltage Drop | 1.2 Vrms | | at maximum load current |
| Maximum Operate Time | | 1 ms | | |
| Maximum Release Time | | 1/2 cycle +1ms | | |
| Insulation Resistance | | Minimum 1,000 M Ω (at 500 VDC) | | for input-output |
| Dielectric Strength | | 2,500 Vrms 1 minute | | for input-output |
| Operating Temperature Range | | -30°C to + 85°C | | |
| Storage Temperature Range | | -40°C to +100°C | | |
| Case Color | | Black | | |
| Weight | | Approximately 4.0 g | | |

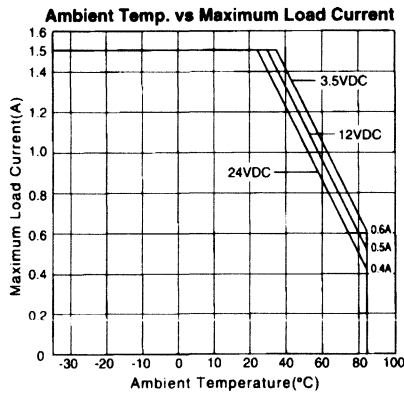
SE SERIES

■ BLOCK DIAGRAM

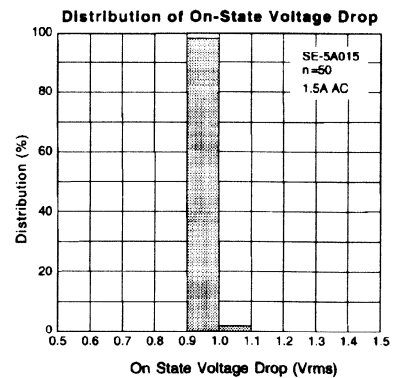
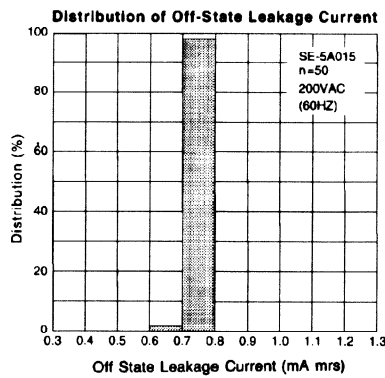
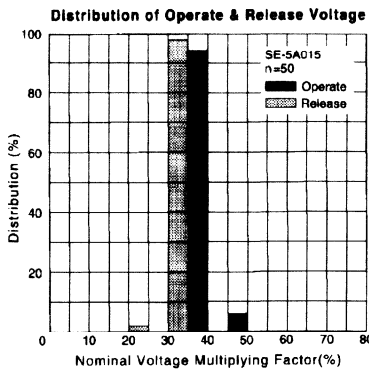


■ CHARACTERISTIC DATA

SE-()A015 type



■ REFERENCE DATA

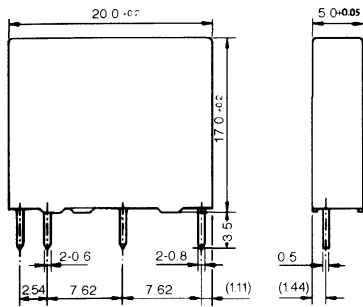


SE SERIES

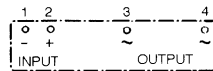
■ DIMENSIONS

● Dimensions

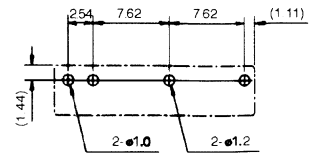
SE- () A015 type



● Schematics (BOTTOM VIEW)



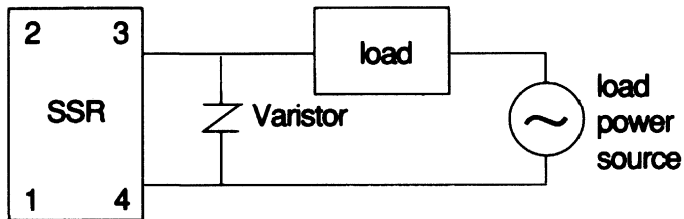
● PC board mounting hole layout (BOTTOM VIEW)



Unit: mm

■ NOTES

When large noise and surge are impressed on the load side, there is the possibility of the occurrence of malfunction or damage. In such a case, a varistor should be inserted in the circuit.



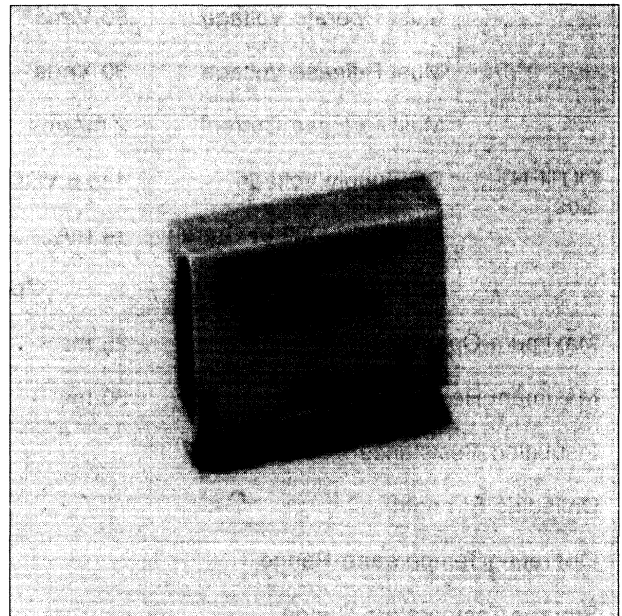
SOLID STATE RELAY (I/O Module)

MAXIMUM LOAD CURRENT 1 A

SN SERIES

■ FEATURES

- I/O modules for interface between CPU and external input devices or loads
- Ultra slim and light weight, SIL terminals type I/O modules for high density mounting
 - Size: 5 (W) x 20 (L) x 17 (H) mm
 - Weight: approximately 3.0 to 3.5 g
- High isolation by employing photo-coupled devices (between input and output: 2,500 V rms)
- Long life and maintenance free
- All solid state I/O module
- Compatible with NY relay size and terminals arrangement (only output module type)



■ ORDERING INFORMATION

● INPUT MODULE

[Example] SN - A 100 B
 (a) (b) (c) (d)

| | | |
|-----|-----------------|---|
| (a) | Series Name | SN : SN Series |
| (b) | Input Voltage | A : AC type D : DC type |
| (c) | Nominal Voltage | 100 : 100 VAC 12/24 : 12/24 VDC |
| (d) | Buffer | Nil : No buffer type B : Buffer type |

● OUTPUT MODULE

[Example] SN - 12 D 01 HZ - S
 (a) (b) (c) (d) (e) (f)

| | | |
|-----|---|---|
| (a) | Series Name | SN: SN Series |
| (b) | Nominal Voltage (Input side) | 3 : 3 VDC (only AC type) 5 : 5 VDC 12 : 12 VDC 24 : 24 VDC |
| (c) | Load Voltage | A : AC type D : DC type |
| (d) | Load Current | 01 : 1 A |
| (e) | Kinds of Inverse Connection Protecting Element (only DC Type) | Nil : Diode HZ : Zener diode |
| (f) | Terminal Classification | Nil : PC board mounting type S : Socket mounting type |

SN SERIES

■ SPECIFICATIONS

• INPUT MODULE (SN-() B Type)

| Item | | AC Input module | DC Input module | | Remarks |
|-----------------------------|------------------------|---|--------------------------|---------------------------|-----------------------|
| | | 100 VAC Type | 12/24 VDC Type | | |
| INPUT side | Input Voltage Range | 80 to 132 Vrms | 9.6 to 28.8 VDC | | |
| | Rating Input Current | Approx. 7 mArms | Approx. 5 mA (at 12 VDC) | Approx. 10 mA (at 24 VDC) | |
| | Power Frequency Range | 47 to 63 Hz | — | — | |
| | Must Operate Voltage | 80 Vrms | 9.6 VDC | | |
| | Must Release Voltage | 30 Vrms | 5.0 VDC | | |
| | Must Release Current | 2 mArms | 1.5 mA | | |
| OUTPUT side | DC Supply Voltage | 4 to 6 VDC | | V _{DD} | |
| | Maximum Output Current | ±4 mA | ±0.4 mA | | V _{DD} = 5 V |
| | Output Logic | Operate with negative true logic (active low) | | | |
| Maximum Operate Time | | 25 ms | 10 ms | | |
| Maximum Release Time | | 30 ms | 10 ms | | |
| Insulation Resistance | | Minimum 1,000 M Ω (at 500 VDC) | | | for input-output |
| Dielectric Strength | | 2,500 Vrms 1 minute | | | |
| Operating Temperature Range | | -30°C to + 85°C | | | |
| Storage Temperature Range | | -40°C to +100°C | | | |
| Case Color | | Yellow | White | | |
| Weight | | Approximately 3.3 g | | | |

SN SERIES

• OUTPUT MODULE

| Item | | AC Output module | DC Output module | Remarks | |
|-----------------------------|--------------------------------|--|---------------------|-------------------------|--|
| INPUT side | Nominal Voltage (DC) | 3 V, 5 V, 12 V, 24 V | 5 V, 12 V, 24 V | | |
| | Operate Voltage Range | ±20% of nominal voltage | | | |
| | Must Operate Voltage | 80% of nominal voltage | | | |
| | Must Release Voltage | Minimum 1 V (minimum 0.5 V*) | | *3 VDC type | |
| | Input Impedance | 3 VDC Type | 180Ω ±10% | — | |
| | | 5 VDC Type | 390Ω ±10% | | |
| | | 12 VDC Type | 1,200Ω ±10% | | |
| 24 VDC Type | | 2,700Ω ±10% | 2,400Ω ±10% | | |
| OUTPUT side | Load Voltage Range | 24 to 265 Vrms | 3 to 30 VDC | | |
| | Maximum Load Current | 1.0 Arms | 1.0 A | see CHARACTERISTIC DATA | |
| | Minimum Load Current | 10 mArms | 1 mA | | |
| | 1 Cycle Surge Current | 50 A (60 Hz) | 3 A (10 ms) | | |
| | Max. Off-State Leakage Current | 1.5 mArms (at 100 Vrms 60 Hz) 3.0 mArms (at 200 Vrms 60 Hz) | 0.1 mA (at 30 VDC) | | |
| | Max. On-State Voltage Drop | 1.2 Vrms | 1.2 V | at maximum load current | |
| Maximum Operate Time | | 1 ms | | | |
| Maximum Release Time | | 1/2 cycle + 1ms | 1 ms | | |
| Insulation Resistance | | Minimum 1,000 MΩ (at 500 VDC) | | for input-output | |
| Dielectric Strength | | 2,500 Vrms 1 minute | | | |
| Operating Temperature Range | | -30°C to + 85°C | | | |
| Storage Temperature Range | | -40°C to +100°C | | | |
| Case Color | | Black | Red | | |
| Weight | | Approximately 3.5 g | Approximately 3.0 g | | |

SN SERIES

■ BLOCK DIAGRAM

• INPUT MODULE

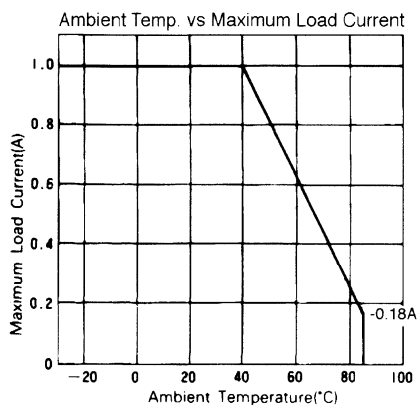
| LOAD | INSULATION | CIRCUITS | Input/Output waveform (resistive load) |
|-----------------|--------------------------|----------|--|
| DC Logic output | Photo-transistor coupler | | Input signal: ON (sine wave), OFF (zero) Output signal: "H" (high), "L" (low) |
| | Photo-transistor coupler | | Input signal: ON (high), OFF (low) Output signal: "H" (high), "L" (low) |

• OUTPUT MODULE

| LOAD | INSULATION | CIRCUITS | Input/Output waveform (resistive load) |
|------|--------------------------|----------|--|
| AC | Photo-triac coupler | | Source voltage of load: sine wave Input signal: ON (high), OFF (low) Load current: sine wave |
| DC | Photo-transistor coupler | | Input signal: ON (high), OFF (low) Load current: pulse |

■ CHARACTERISTIC DATA

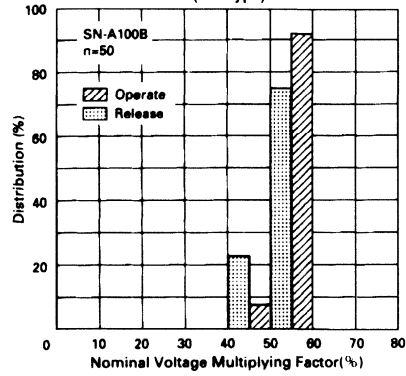
• OUTPUT MODULE



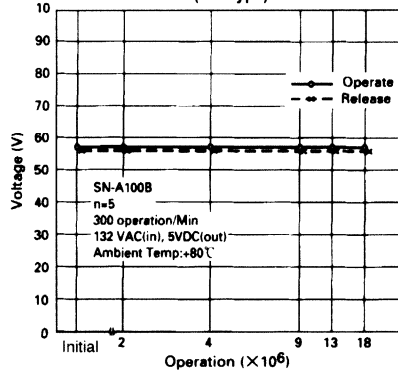
■ REFERENCE DATA

● INPUT MODULE

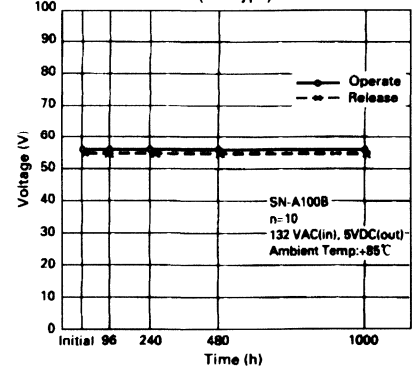
Distribution of Operate & Release Voltage
(AC Type)



High temperature Switching Test
(AC Type)

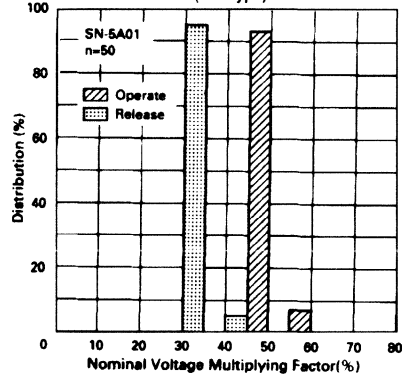


High temperature Continuous Operating Test
(AC Type)

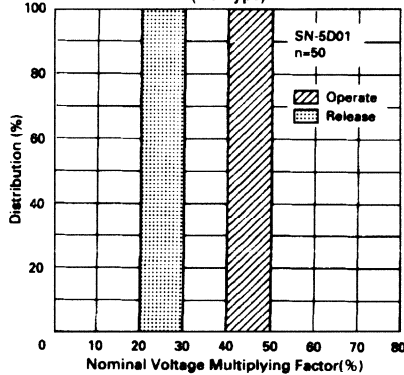


● OUTPUT MODULE

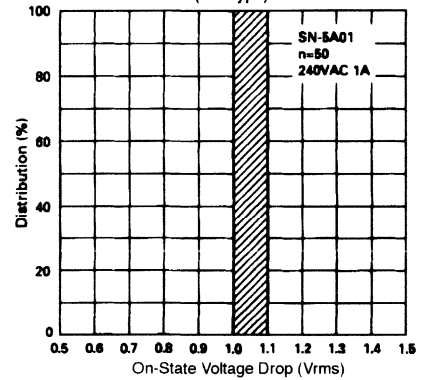
Distribution of Operate & Release Voltage
(AC Type)



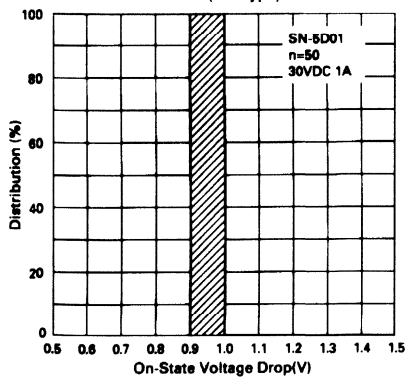
Distribution of Operate & Release Voltage
(DC Type)



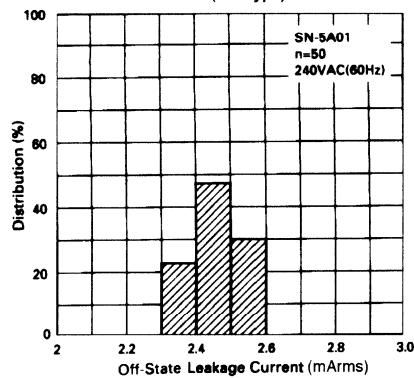
Distribution of On-State Voltage Drop
(AC Type)



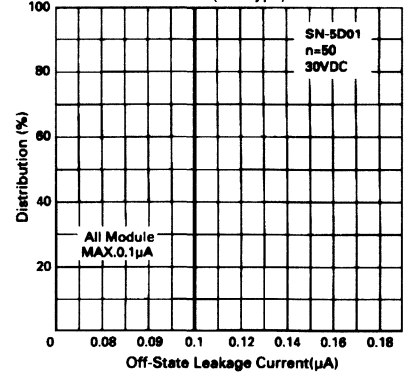
Distribution of On-State Voltage Drop
(DC Type)



Distribution of On-State Leakage Current
(AC Type)



Distribution of On-State Leakage Current
(DC Type)

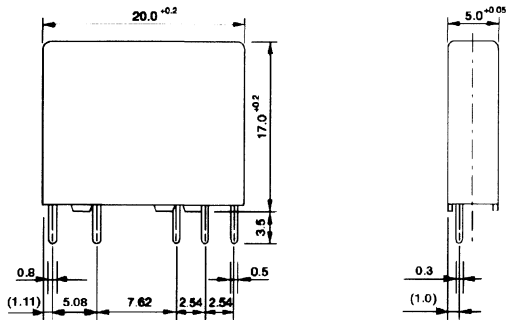


SN SERIES

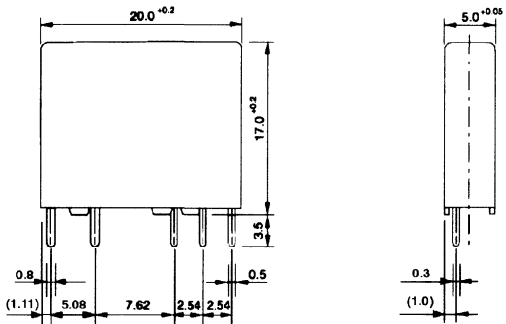
■ DIMENSIONS

● Dimensions

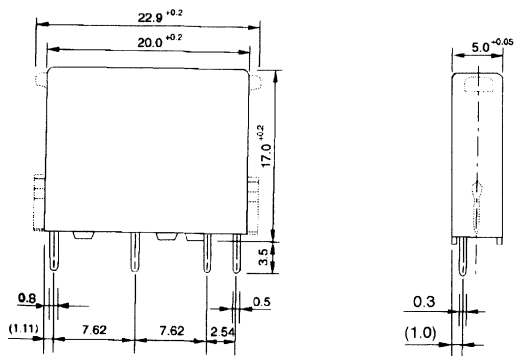
SN-A () type (input module)



SN-D () type (input module)

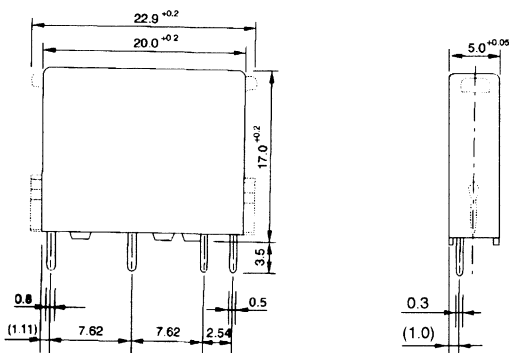


SN-A () type (output module)



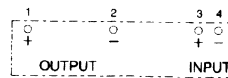
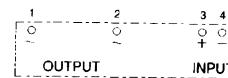
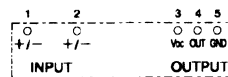
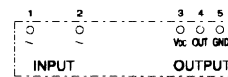
Dotted line : Socket mounting SN-()A-S type

SN-D () type (output module)

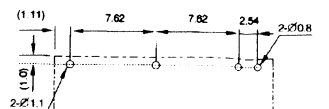
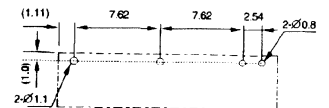
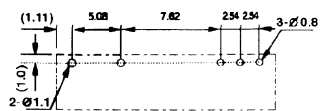
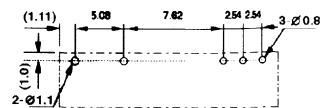


Dotted line : Socket mounting SN-()D-S type

● Schematics (BOTTOM VIEW)



● PC board mounting hole layout (BOTTOM VIEW)



Unit: mm

SN SERIES

NOTES



ENGINEERING REFERENCE

RELAY ENGINEERING REFERENCE —Contents—

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1. TYPES OF RELAYS

1.1 Relay Mounting and Terminal Shape

- (1) Printed Circuit Board Relay
This relay is designed to be directly mounted onto printed circuit boards. More than 90% of relays are currently this type.
- (2) Plug-in Relay
This relay is attachable to fixed socket or terminal table.
- (3) Bracket fixing Relay
This relay is a type of fixing upside or bottom of cover with screw.

1.2 Printed Circuit Board Relay

We at FUJITSU TAKAMISAWA COMPONENT have achieved both high sensitivity and sub-miniaturization with successful features as described below:

- (1) Dimensions on each piece parts were decided by detailed analysis of magnetic circuit all relays.
- (2) High-efficient magnetic circuit was developed by setting an armature in a high magnetic field inside of exciting coil and minimizing external reluctance to increase attracting force
..... FBR20H, SY, RY, JY relays, etc.
- (3) High sensitive magnetic circuit was developed by using permanent magnet
..... FBR10, FBR46, A, RA, RA4 relays, etc.

1.2.1 Types of sub-miniature relays

The sub-miniature printed circuit board relay is classified by outside dimensions into flat, slim and cubic types, which are shown in Fig. 1.1 accompanied with description of their main features.

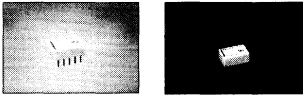
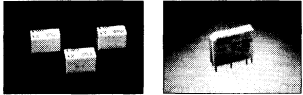
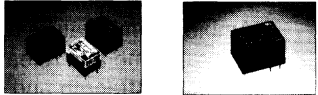
| | Flat Type | Slim Type | Cubic Type |
|-----------------|--|--|--|
| Appearance |  A AS |  FBR10 NY |  FBR210 LZ |
| Characteristics | <ol style="list-style-type: none"> 1. A particularly low height compared with the length of one bottom edge. 2. This type is suitable to be incorporated in thin body equipment or used in a small distance space, and used with printed circuit board(s) mounted on a rack. | <ol style="list-style-type: none"> 1. A particularly short length of one bottom edge compared with height. 2. Suitable in case where the area allotted to printed circuit board is limited to a small one or where the only requirement is to be of a lower height compared with other components such as transformer and capacitor. | <ol style="list-style-type: none"> 1. Rather close to cubic, apart from flat type as well as slim type. 2. A smaller space as a whole. |

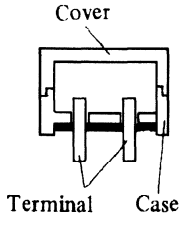
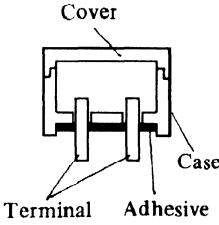
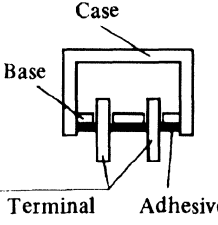
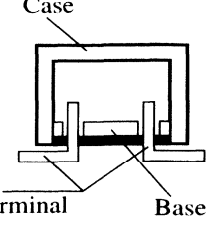
Fig. 1.1 Types of compact relays

1.2.2 Structure of sub-miniature relays

This relay is classified into 4 types by the structure of terminal holes in the case, structure between case and base or cover and mounting pattern of relay onto printed circuit board: enclosure type, flux free type, plastic sealed type (washable type) and surface mount type, which are shown in Fig. 1.2.

- **Enclosure type:** There is a gap between cover and case or terminals and body of case. This structure needs manual soldering, because, if soldered automatically, there is the possibility of contaminating the contact housed in relay with flux used when mounting the relay on printed circuit board, which can penetrate, in a molten state, into the interior of relay.

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| Relay type Item | Enclosure Type | Flux Free Type | Washable Type (Plastic Sealed Type) | Surface Mount Type |
|-----------------------------------|--|---|--|---|
| Structure |  |  |  |  |
| Characteristics | There are gaps between terminals and the body of the case as well as between the cover and the case, respectively. | The gaps between terminals and the body of the case are sealed by adhesive and the distance from bottom to the level where the cover and the case fit is significantly large. | All gaps such as those between terminal-base and case-base are sealed by adhesive. | All gaps such as those between terminal-base and case-base are sealed by adhesive. Terminals are bent in the form of gull wing. |
| Mounting pattern | Insertion mounting | Insertion mounting | Insertion mounting | Surface mounting |
| Automatic flux coating | × | ○ | ○ | ○ |
| Automatic soldering | × | ○ | ○ | ○ |
| Automatic washing (whole washing) | × | × | ○ | ○ |
| Manual soldering | ○ | ○ | ○ | △ |

Note: ○: suitable; ×: unsuitable; △: includes both of suitable and unsuitable

Fig. 1.2 Relationship between relay structure and soldering pattern

- **Flux-free type:** In this model, the gaps between terminals and body of case are sealed by adhesive and the distance from bottom to the level where cover and case fit is large enough not to allow flux to penetrate into the interior along terminals by the effect of capillary phenomenon. However, the whole washing is not allowed.
- **Plastic sealed type (Washable type):** The gaps between terminals and body of case or base as well as case and base or cover are all plastic-sealed. No flux can enter the interior and the whole washing is allowed.
- **Surface mount type:** For all the three types mentioned before, the terminals inserted into the holes drilled in printed circuit board are soldered from the back side of the board.

To the contrary, no hole is drilled in printed circuit board for this model but the conductive patterns arranged on the mounting face of board and terminals of relay are electrically connected and then the relay is bonded to the board. Usually this relay assembly is plastic-sealed.

These plastic sealed relays have no fear of the contact being contaminated with dust or oil mists and have large effect to screen harmful gases for the contact.

1.2.3 Printed circuit board relay mounting and soldering patterns

There are patterns in mounting and soldering as shown below. They should be selected with careful consideration of the structure and form of relay.

- (1) Insertion mounting
 - 1) Manual soldering
 - 2) Automatic soldering: no whole washing
 - 3) Automatic soldering: whole washing
- (2) Surface mounting

The item 2) in (1) needs the use of flux free type or plastic sealed type and the item 3) needs the plastic sealed type.

The item (2) needs, of course, the use of surface mount type relay.

For the insertion mount type relay, the thickness of printed circuit board includes 0.8, 1.2, 1.6 and 2.0 mm. However, a thickness of 1.6 mm is suitable for ordinary use from the standpoint of relay's dead weight, so that standard length of terminal of the relay is matching the thickness of 1.6 mm.

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The location and diameter of terminal holes for each relay are described in each appropriate catalogue. The cross sectional area of each relay terminal is determined according to its carrying current capacity, so that the sizes of the holes in boards for the relays with a larger current capacity should be comparatively large.

1.2.4 Polarized latching and non-latching relays

As to the operating characteristic of these relays, the non-latching relay is restored when the coil is deenergized after it is once energized to make the relay actuated. In contrast, in the latching relay, operation (set) and release (reset) are conducted using each pulse current, a set or reset state is maintained even if energizing current is suspended after it is once set or reset, therefore, no need of power supply to maintain a set or reset state. This phenomenon results from the magnetic pull force by remanent magnetism.

The latching relay is available in polarized latching type.

• Polarized latching type relay

The polarized latching type relay incorporates a permanent magnet in part of the magnetic circuit. Its remnant attraction ensures that the latching characteristics are maintained. This relay is available in two types; a single-coil latching type and a double-coil latching type. The polarized type relay is set or reset by supplying a driving pulse larger than the predetermined setting or resetting voltage (current) to the coil. Fig. 1.3 shows an example of the operating characteristics of a polarized latching relay. Usually, a pulse width of around 10 ms is sufficient to set or reset a polarized type relay. With the single-coil relay, setting or resetting are performed by reversing the polarity of the current supplied to the coil whereas the double-coil type features setting and resetting coils equipped with respective terminals and is operated by supplying voltage (current) of predetermined polarity to the respective coils.

A, FBR46 and RA type relays have variations of the polarized latching type relay.

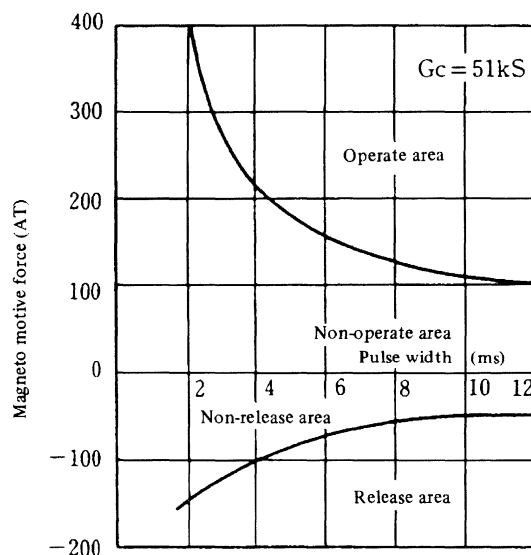


Fig. 1.3 Operating characteristics of polarized latching relay

1.2.5 High frequency relay

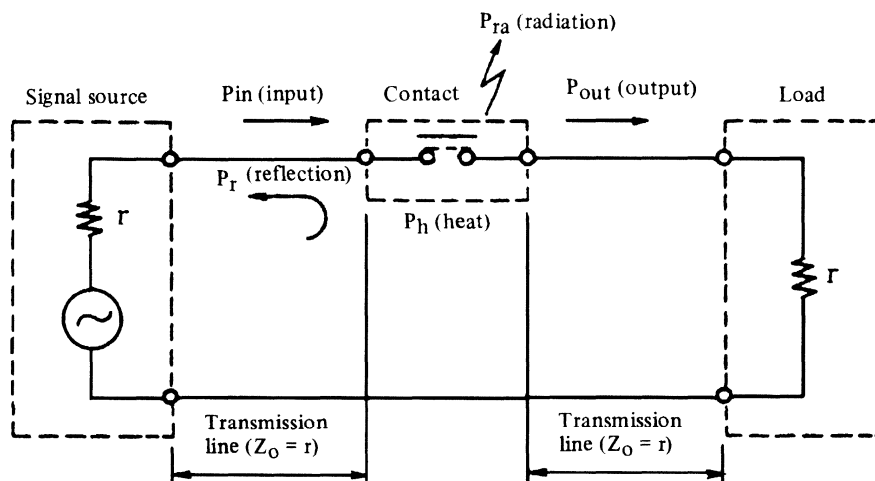
In recent years, high frequency signals such as VHF and UHF have been widely used. The equipment dealing with such signals is equipped with a high frequency relay with outstandingly improved high frequency characteristics as a signal switching element.

The high frequency relay requires the following three characteristics, which will be explained using a model circuit shown in Fig. 1.4.

Considering losses, the transmission impedances in high frequency circuits are unified into 50Ω or 75Ω and so the high frequency relays, too, are used under the same conditions.

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- (1) Isolation characteristics: This indicates the level of signal leakage across the contact which are in an open state. Generally the leak is increased with increase in frequency of signal. The isolation is expressed by the following formula. The larger the value the better the isolation.



Note: If assumed to be an ideal status as no loss, no reflection and no leak in signal source, load and transmission line, then: $P_{in} = P_{out} + P_r + P_{ra} + P_h$ $Z_0 = 50\Omega$ or 75Ω

Fig. 1.4 A model circuit for signal application to relay contact

$$\text{Isolation} = -10 \log \frac{P_{out} \text{ (output power)}}{P_{in} \text{ (input power)}} \text{ (dB)} \dots \dots \dots (1)$$

- (2) Insertion loss characteristic: This indicates the signal insertion loss in a closed state of contact. With increase in frequency of signal, each loss is increased, as a result, the insertion loss is increased together. Insertion loss is defined by the following formula. The smaller the value, the more desirable the status is.

$$\text{Insertion loss} = -10 \log \frac{P_{out} \text{ (output power)}}{P_{in} \text{ (input power)}} \text{ (dB)} \dots \dots \dots (2)$$

- (3) Return loss characteristic or V.S.W.R.: This indicates the signal reflection loss in a closed state of contact. With increase in frequency of signal, the reflection is increased. The return loss is expressed by the following formula. The larger the value, the smaller the reflection.

$$\text{Return loss} = -10 \log \frac{P_r \text{ (reflection power)}}{P_{in} \text{ (input power)}} \text{ (dB)} \dots \dots \dots (3)$$

The reflection characteristic is expressed by V.S.W.R.: (voltage standing wave ratio), too, which can be calculated from return loss by use of following formula:

$$\text{Reflection coefficient } \rho = 10^{-\frac{RL}{20}} \dots \dots \dots (4)$$

where RL: return loss (dB)

$$\text{V.S.W.R.} = (1 + \rho) / (1 - \rho) = (1 + 10^{-\frac{RL}{20}}) / (1 - 10^{-\frac{RL}{20}}) \dots \dots \dots (5)$$

Here, V.S.W.R. ≥ 1 . The closer to 1, the smaller the reflection.
To improve the high frequency characteristic, the high frequency relay is provided with a number of earth terminals. UM1 and UR1 type relays are categorized in high frequency relay.

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1.2.6 Solid State Relay (SSR)

The solid state relay is a semi-conductor relay, often called, simply, "SSR."

The SSR is equipped with a set of output and input terminals insulated from each other by means of photo coupler.

Once an input signal is applied to the input terminal, the output terminal is closed, allowing a current to flow in the load circuit.

SSR is of a contactless type and has a capability of high speed and high frequency switching operation so that in recent days it has been widely used, substituting for traditional contact type relays.

Since the SSR, as mentioned above, is equipped with no movable part, it has the following strong and weak points compared with electromagnetic relays:

- 1) A longer lifetime due to contactless system
- 2) Quick response
- 3) No malfunction caused by vibration and shock
- 4) No degradation in performance caused by dust, gas, etc.
- 5) Rather weak in resistance to external noises
- 6) The SSR for use for large current loads requires a heat sink device to avoid excessive heat generation, resulting in difficulties in giving it a compact structure.

• Block diagram

Fig. 1.5 is the block diagram of an example of a SSR equipped with photo coupler, in which the insulation system, circuit construction and input and output wave form are represented for each of AC and DC loads.

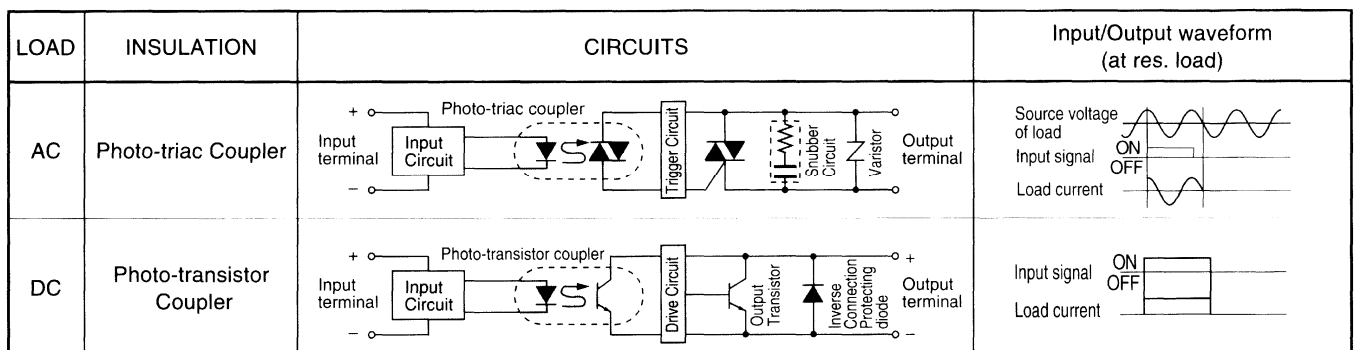


Fig. 1.5 An example of block diagram

2. HOW TO SELECT AND USE RELAY

2.1 How to select relay

2.1.1 Main points to select proper relay

Main points to select proper relay are as follows:

- (1) Points for contact
 - 1) Forms and number of contact combinations
 - 2) States of contact load
AC or DC?; resistive or inductive or capacitive or lamp?; occurrence of back electromotive force or inrush current?
 - 3) Level of contact load
Large or small current?; Switch on or not for current load?; Switch off or not for current load?
 - 4) Frequency in switching operation
 - 5) Demand for life in switching operation
- (2) Points for coil
 - 1) Coil power source
DC or AC?
 - 2) Fluctuation in supply voltage
 - 3) Energizing method and circuit
Necessity of special energizing circuit
 - 4) Coil resistance
 - 5) Operate and release voltages
 - 6) Operate time and release time

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- (3) Insulation
 - 1) Dielectric strength
 - 2) Insulation resistance
 - 3) Surge strength
- (4) Environment
 - 1) Range of ambient temperature or humidity
 - 2) Environmental atmosphere
 - 3) Vibration and shock
- (5) Mounting
 - 1) Outside dimensions
 - 2) Fixing and soldering of terminals
 - 3) Mounting method
- (6) Others
 - 1) Safety standards and other standards
 - 2) Special specifications or conditions

2.1.2 Contact

2.1.2.1 Contact load

The phenomena in the contact of magnetic relay greatly vary depending on contact load and current level as well as contact material and size, opening speed and contact bounce at switching operation.

- (1) The allowable contact-switching current for DC load is smaller than that for AC load
AC current is periodically reduced to zero but DC current is not, so the arc discharge current at shutoff of current is hard to extinguish for DC current as compared with AC current. The duration of arc discharge is longer in DC circuit than in AC circuit. The allowable maximum contact -switching current is smaller for DC load than for AC load.
Be careful of the difference between the max. switching load listed in catalog for AC and DC ones.
- (2) The inrush and breaking currents in resistive load circuit are equivalent to those in steady state
Resistive load is used as a standard load in life test and reliability test. The contact life listed in catalog is based on resistive load.
As to loads for practical use, there is no load composed of resistance only. But some heaters are very close to this status.
- (3) A high back electromotive force at caused in breaking in inductive load circuit
Electromagnetic relays, solenoids and motors are the inductive load. They generate a high back electromotive force between relay contacts when they break in their circuits, which causes arc discharge.
As power factors of those devices are widely distributed, the contact life for respective power factor is listed in the catalog. It should be taken into consideration that the life is decreased as the power factor is lowered. According to circumstances, a spark quenching device should be used. (Refer to Fig. 2.3).
In a circuit with such a load as motor, solenoid and transformer, an inrush current 5 to 15 times as large as the steady current is generated at the instant of energizing, so the contact of selected relay should have a sufficiently large surplus allowable load.
- (4) A large inrush current in capacitive load
In a circuit with a load of capacitor, an inrush current 20 to 40 times as large as the steady current is often produced, causing contact welding failure. Care should be taken with a long transmission line or cable capacitance. In accordance with circumstances, a surge suppressor should be used. (Fig. 2.4)
- (5) A large inrush current in lamp load circuit
In a lamp load circuit, an inrush current 10 to 15 times as large as the steady current is produced, causing contact welding failure. Careful selection for a relay suitable for inrush current is required.
- (6) High frequency load requiring special characteristics
Nowadays, relays are used to switch high frequency signals of 30 to 1,000 MHz. These relays are required to have high level of isolation, insertion and return loss characteristics which are not demanded for DC loads and low frequency AC loads.
The relays included in this category are UM1 and UR1 type relays.
Table 2.1 outlines the types of loads and levels of inrush current.

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Table 2.1 The types of loads and level of inrush current

| Types of loads | Level of inrush current |
|-------------------|--|
| Incandescent lamp | 10~15 times as large as the steady current |
| Mercury lamp | About 3 times as large as the steady current |
| Fluorescent lamp | 5~15 times as large as the steady current |
| Motor | 5~15 times as large as the steady current |
| Solenoid | 10~20 times as large as the steady current |
| Contactoer | 3~10 times as large as the steady current |
| Condenser | 20~40 times as large as the steady current |
| Transformer | 5~15 times as large as the steady current |

2.1.2.2 Selection for the relays by contact load

The range of currents to be applied to relay contact runs wide from an order of μA to around 30 A. A large current load causes the contact arc discharge the moment of switching. The phenomena appearing at contact are greatly different by arc discharge. Therefore, we show relays corresponding to contact load classified as Table 2.2. The criterion for classification is arc current. Each value of minimum current in this Table is just a rough reference.

Table 2.2 Classification of contact load current

| Classification | Nominal current | Minimum current | Note |
|--------------------------------------|-----------------|-----------------|------------------------------------|
| From micro current through small one | 100 mA | 0.05 mA | Range does not have arc discharge. |
| Small current | Several Amps. | 10 mA | Arc discharge is found. |
| Medium current | ~ 15 A ~ | 500 mA | Arc discharge shows up strongly. |

(1) Relays for current loads ranging from micro through small one

The maximum current to be switched in this classification is about 1 to 2 A.

The relays, in this classification are suitable to be used in signal transmission equipments such as communication apparatus.

Increase in contact resistance:

The contact resistance is the most prominent problem in this micro current range use. The possible causes of increase in contact resistance are as follows:

Films formed on the contact surface (oxides, sulfides, etc.) resulting from harmful gases in atmosphere (sulfide gas, chloride gas, nitrogen oxide, ammonia, benzene, styrene, etc. exhausted from cars, spa and paints), deposits (brown powder and black powder) and dust.

Contact resistance stabilizing measures:

The contact resistance stabilizing measures for microcurrent relays are as follows:

- 1) Use of contact made of gold clad Ag-Pd alloy or gold clad Ag
- 2) Use of twin contact
- 3) Increase of contact wipe
- 4) Adoption of sealed relay

(2) Relays for current loads ranging from small through medium ones

The level of current in this range is 3 to 5 A in maximum contact rating.

The use of relay in this range is versatile, such as household appliances, air conditioners, audio devices, business machines and car devices.

By applying the same material and structure as those for microcurrent loads to the contacts in this range or employing a material with excellent antiweldability as the contact material, it is capable to apply the same type relay for loads from microcurrent through 5 or 10 A.

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Electrical wear of contact:

The problems in this current load range are electrical wear and weld.

The arc discharge at contact arise in large current load. This causes wear and/or transition of contact material, welding, bridging, etc., resulting in failures and/or reduction in life of the contact.

Also, the deposition of scattered contact material on the insulators in the vicinity of contact causes degradation in insulation resistance, often leading to life-end of the relay.

Measures against wear and weld of contact:

The measures against electrical wear and weld to keep the stabilization of quality and performance are as follows:

- 1) Selection of material and dimensions reliable enough for the contact to guarantee the life described in the catalog.
 - 2) Adoption of such a contact spring assembly structure as be able to easily obtain the contact with satisfactory contact follow and force.
 - 3) Expansion of contact wipe to secure the stabilization of contact resistance and improvement in resistivity against contact weld.
- (3) Relays for current loads ranging from medium through large ones:
With the recent trend towards small-sized equipment, miniature relays have been penetrating into a part of the area of electromagnetic contactor. The level of current in this range is 15 to 30 A in maximum contact rating.
In the relays in this category, the phenomena as mentioned in the description of effects of small through medium current loads occur more intensively, so that the materials resistance to welding and bridging such as AgCdO and AgSnO₂ are used as contact materials. Also, to reduce heat generation, the relays in this range are constructed with large-sized contacts and springs made of a material with a large conductivity.

2.1.2.3 Switching frequency of contact

If the switching frequency is excessively large in a contact subject to intensive arc discharge at switching due to a large contact load, the contact and contact spring will be extraordinarily heated by the effect of arc discharge, leading to shortening in contact life.

Usually, the contact lives listed in catalogs are those tested under the following switching frequencies. If a larger frequency is expected, make a confirmation test.

| Contact-switching current load | Standard switching frequency |
|--------------------------------|------------------------------|
| Under 3 A | 1 sec. ON, 1 sec. OFF |
| 3 A or greater | 3 sec. ON, 3 sec. OFF |

2.1.3 Winding and energization

2.1.3.1 AC relay and DC relay

(1) Alternating current (AC) relay

Generally, A portion of the pole of AC relay is equipped with a shaded ring, which operation is carried out by direct energization from alternating-current source.

In this type of relay, the armature vibrates and beats at a voltage of less than operate value, so that the drop of supply voltage during, e.g., a period of motor startup is accompanied with beat of armature and can cause burning or welding of contact.

Nowadays, the set of sub-miniature relay and rectifier are used as AC relay because of easy availability of high performance and quality rectifiers.

(2) Direct current (DC) relay

The magnetic pull force for drive of relay is generated by a magnetomotive force expressed in product of current and number of turns of winding; therefore, the coil current is the base of pull force.

From the standpoint of use of relay, however, voltage is convenient in most cases compared with current so that usually the kind of winding is selected on the basis of voltage.

In general relay, the resistance and number of turns of winding are selected on the basis of drive voltage. In other words, if, for instance, the drive voltage is different between two relays, the resistance and number of turns of winding are also different between them.

The nominal voltages of coils is a voltage correspond to the base of energization. Usually the standard nominal voltages are 1.5, 3, 4.5, 5, 6, 9, 12, 18, 24, 36, 48, 60, and 100 VDC. As to the standard nominal voltage of each type of relay, refer to the list in appropriate catalog.

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(3) Fluctuation in power source

Any of rectified DC current from AC source, battery and dry cell are available as the power source of DC relay.

Ripple of rectified current is 5% or less:

The current with no ripple is ideal as the current source for DC relay. In practice, however, the criterion for ripple is generally defined as 5% or less. This percentage of ripple is that calculated using the formula described in Fig. 2.1. As to the fluctuation in voltage, refer to next paragraph for battery.

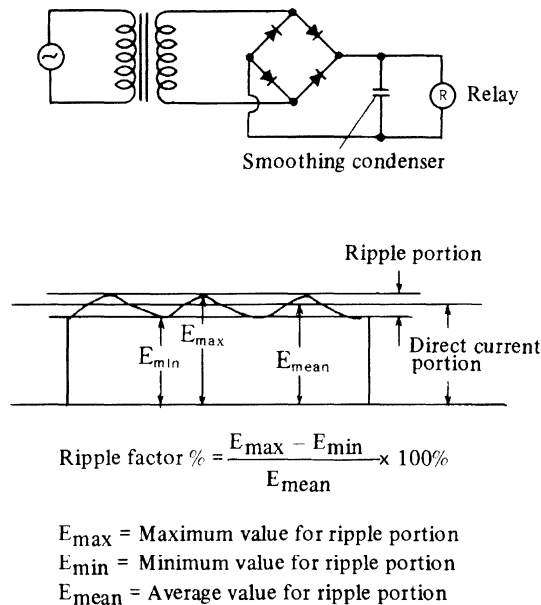


Fig. 2.1 Ripple factor of rectifications's circuit

Battery or dry cell as power source:

Excessively large fluctuation in voltage can cause suspension of relay operation at around lower limit of voltage and burning or degradation of coil at around upper limit.

It is required, therefore, to check for fluctuation in supply voltage beforehand and select a relay capable of operating safely at required ambient temperatures. The relations between ambient temperature and applicable voltage are described in Section 2.1.4.6.

2.1.3.2 Special winding circuit

For the circuit such as a pulse current is used for operation and release of relay and power is not supplied for maintenance of operation and release statuses, the latching relay should be selected. The winding latching relay includes one coil type and two coil type.

The one-coil type relay uses the same coil but changes the polarity of pulse current for both of operation (setting) and release (resetting). In the two-coil type relay, in contrast, the operation coil (set coil) and release coil (reset coil) are connected to the operation (set) and release (reset) circuits, respectively.

For setting or resetting in polarized latching relay, each of a pulse current corresponding to coil's nominal voltage, or a pulse current larger than the operation and release current respectively is available.

In non-polarized latching relay, in contrast, a pulse current within a specified range or the nominal voltage, in the release current circuit with a specified resistance must be applied to release the relay being in an operation (set) status, because the release (reset) current is required to be less than the reoperation current.

2.1.3.3 Input power demand and coil resistance

(1) Input power as one important factor for selection of relay

The input power of each relay is listed in the coil data chart of catalog. The input power of recent subminiature relays are as small as shown in the following:

Large current power relays 1.2 W; medium through small current general purpose relays 0.7 W to 0.2 W; less than small current general purpose relays 0.6 W to 0.15 W.

The lower input power as mentioned above contributes to power saving and opens the way for high density mounting because of low heat generation, thus it has become an important factor for selection of relay.

ENGINEERING REFERENCE

(2) Coil resistance

The resistance of each coil is specified according to the nominal voltage of the coil while the input power is specified for each type of relay.

In the general relays, the nominal value of each coil resistance is at 20°C and the allowable deviation is limited to within $\pm 10\%$.

Most of magnetic coil wires are polyurethane enameled copper wires. The resistance of Cu wire increases/decreases $\pm 0.4\%$ as the temperature does by 1°C.

2.1.4 Performance

2.1.4.1 Contact resistance

(1) Outline

The contact resistance of relay contact consists of constriction resistance, which arises from focusing of current to a small area of contact pieces being in contact with each other, and transition resistance (film resistance) of the film layers being in contact with each other.

The contact resistance of clean surfaces is extremely small, such as several m Ω . In practice, however, some kind of film layer is formed on the almost all of contact surfaces and the contact resistance varies depending on the physical properties of the film.

Usually, the contact resistance is measured between terminals of relay so that the conductor resistance of contact spring is included in the value of contact resistance.

(2) The relationship between contamination of contact surface and contact resistance

The possible causes of contamination, which effects increase in contact resistance, are as follows:

- 1) Adherence of fiber, scale and particles of plastic mold, powdery soil, etc.
- 2) Adherence of silicone oxides
- 3) Adherence of various kinds of non-conducting material and deposits of non-conducting material produced through chemical reaction with the gas adsorbed onto the contact face.
- 4) Oxidation and sulfuration of metallic powders in adherence to contact surface
- 5) Oxidation and sulfuration of contact material itself
- 6) Adherence of organic powders by friction
- 7) Adherence and deposition of carbon powders produced at the surface of contact

(3) Cleaning of contact surface

Effective cleaning methods are as follows:

- 1) Cleaning by air blower: Air blower is usually used at manufacturing process.
- 2) Cleaning by mechanical operation: Collision and rubbing motion of contact occur at mechanical operation of relay, which work to break film layers on contact surfaces. Therefore, the repeat of this operation can effect cleaning of contact surfaces.
- 3) Cleaning by arc discharge: The heat generated by arc discharge works to break the film produced by contamination, resulting in dissipation of contaminants. Therefore, there occurs no contact defect due to contaminant film where the current load is large enough to bring about a high energy arc discharge.

(4) The relationship between contact force, contact wipe and contact resistance

The contact resistance is decreased as contact force is increased but application of a large contact force to sub-miniature relay is incapable. To cover such weak points, countermeasures such as twin contact and sealed relay have been developed and, in addition to them, the distance of contact wipe is increased, which is helpful for stabilized resistance.

As a result, the quality of existing low current level sub-miniature relay has been improved to such a level as a contact force of as small as around 4 g is enough to offer a satisfactory contact reliability.

At the instant of opening and closing of contact, the contact surfaces are slid together, effecting breakage of non-conductive film formed on the contact surfaces. It is proved by tests that several μm of sliding travel is enough to have the surface cleaned, bringing about great reduction in contact resistance.

(5) Plastic sealed relay and contact resistance

If a relay is housed in a plastic case, the increase in contact resistance caused by contaminated atmosphere can be held back. If house and sealed, the effect is certainly improved greatly.

Thus, the plastic sealed sub-miniature relay has advantages such that not only the cleaning at the mounting process is available but also it can be protected during service in field from contamination by gases and dust contained in the atmosphere, as a result, maintain a stable contact resistance.

ENGINEERING REFERENCE

In a plastic sealed, however, the gas produced from the materials of assembled parts is also shut up in the enclosure so that the carbon powders sometimes are deposited on the contact surface and increase in contact resistance and/or wear of contact are accelerated. Therefore, the measures taken actually in the factory to prevent such troubles in seal relays are the selection of materials whose gas release at high temperatures is not significant in amount and/or the adoption of de-gassing treatment at the stage of manufacturing.

(6) Improvement of contact reliability by use of twin contact

The structure of twin contact is such that, as shown in Fig. 2.2, at least one of a pair of contact is composed of bifurcated spring and each bifurcated spring is attached contact piece. In addition, the contact without bifurcated spring is called 'single contact'.

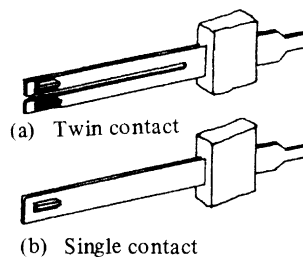


Fig. 2.2 Twin contact & single contact

The bifurcated spring is cut deeply enough so as to keep a good contact even when some insulating particle is trapped between contact surfaces of one side. In that case, the other side contact of twin can always serve to keep a good contact, for the sufficient mechanical independence between the separate twins. Thus, the adoption of twin contact has successfully reduced contact failures.

(7) The relationship between contact voltage/current and contact resistance

Increase in voltage brings about dielectric breakdown of film on contact surfaces, leading to decrease in contact resistance, and increase in current causes increase of Joule heat, resulting in local softening or melting of contact point and, in its turn, reduction in contact resistance.

Thus, the contact resistance varies depending on voltage and current for the contact point so that the evaluation tests of contact resistance should be conducted at a voltage and current near actual ones.

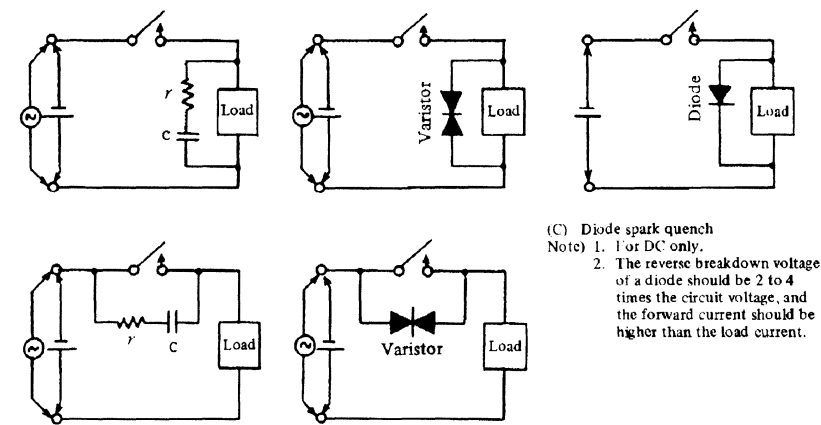
(8) Wear of contact and its influence on contact resistance

The switching operation with no current or micro current load causes almost no wear of contact, e.g. only several μm in wear depth at 10 million switching operation. Thus, the increase in contact resistance by contact wear is negligible in above loads. A spark discharge at switching of contact is sometimes followed by glow or arc discharge. The glow discharge occurs in a relatively small current load whose effect on contact erosion is rather little. The arc discharge is often accompanied with a large quantity of transfer or erosion of contact metal due to its large current density.

When switching operation is conducted in an organic gas atmosphere, the organic gas adsorbed on the contact surface is decomposed to produce carbon powders, resulting in deposition of them on the surface of contact. This status is called "activation of contact", making the contact susceptible to arc discharge. The activation of contact acts to increase the contact resistance if contact load is small. With increase in current load at switching, arc discharge becomes intensive enough to cause erosion of contact metal, which effects reduction in contact force, as a result, making susceptible to contact failures and, to the worst, leading to end of life.

To prevent erosion and transfer of metal, some adequate arc discharge preventing circuit is required. A spark quench device is employed for inductive load. Fig. 2.3 shows examples of circuits equipped with a spark quench device.

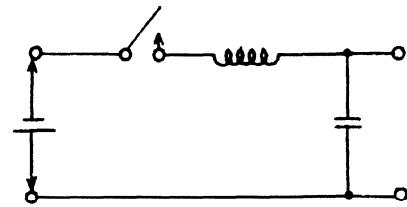
The capacitive load switching operation produces sometimes a short arc discharge and, if contact bounce occurs, a large current arc. Care should be taken that a circuit composed of a long cable release the charges accumulated in the cable, too. Such a circuit requires a surge suppressor as shown in Fig. 2.4.



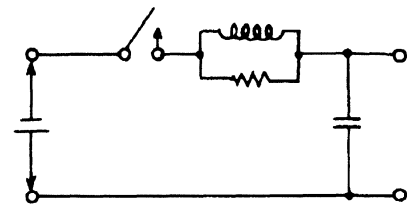
(A) CR spark quench
 Note) 1. Available for both AC & DC.
 2. The capacity of C is 0.1 to 1 μ F, and r is nearly equal to the load resistance.

(B) Varistor spark quench
 Note) Available for both AC & DC.

(C) Diode spark quench
 Note) 1. For DC only.
 2. The reverse breakdown voltage of a diode should be 2 to 4 times the circuit voltage, and the forward current should be higher than the load current.



Choke coil



Surge suppressor

Fig. 2.3 Example of circuits equipped with a spark quench device

Fig. 2.4 Example of surge suppressor

(9) Testing procedure for contact resistance

The detail of contact resistance testing procedure is described in IEC Publication 255-7 Electrical Relays Part 7: "Test and measurement procedure for electromechanical all-or-nothing relays", Whose some essential points are as follows:

- 1) Four terminal testing method shall be applied, in which both of voltage and current terminals are used.
- 2) Testing voltages and currents shall be applied after contact is closed and the contact be opened after the loads are disconnected.
- 3) The testing voltages and currents should be near the actual operating loads, the voltages and currents to be used in tests are specified in above publication.

2.1.4.2 Contact weld

The cause of contact weld is a large current arc discharge produced by the effect of contact bounce at closing. With increase in arc discharge current, the contact weld occur more frequently, especially when loaded with an large inrush current by the effect of capacitive or lamp load and an inrush current as large as exceeding the allowable capacity of the relay employed.

To extend the contact welding life to secure an stable expected contact life, a large contact force and an adequate contact follow are required.

2.1.4.3 Operate voltage and release voltage

There are two methods for the testing procedure of operate and release voltage.

- 1) A method in which voltage is gradually increased or decreased,
 - 2) Another method in which voltage is increased or decreased by steps.
- Usually, in the method 2), the operate voltage tends to be smaller and the release voltage larger.

The standard level of operate voltage is 60 to 80% of the nominal voltage of coil so that relays are able to perform their function even if a small fluctuation occurs in ambient temperature, supply voltage, and resistance and voltage drop of winding circuit.

The standard release voltage is 5 to 10% of nominal voltage, considering the dark current in winding circuit.

All the relays operate at a voltage between operate and non-operate voltages and are released at a voltage between hold and release voltages.

The variation of operate and release voltages of each type of relay is described in each appropriate catalog.

ENGINEERING REFERENCE

2.1.4.4 Relay's temperature rise and operating temperature range

(1) Temperature rise

The relay is heated by the effect of current flows through exciting coil and contact spring, causing temperature rise in component parts. The largest temperature rise occurs in winding. Fig. 2.5 shows the relationship between temperature rise and time in winding.

An example of temperature rise in a steady state at constant supply voltage is shown in Fig. 2.6. This temperature rise per unit power is called thermal resistance of relay. The testing procedures for the thermal resistance and temperature rise are specified in IEC Publication 255-7 Electrical Relays Part 7.

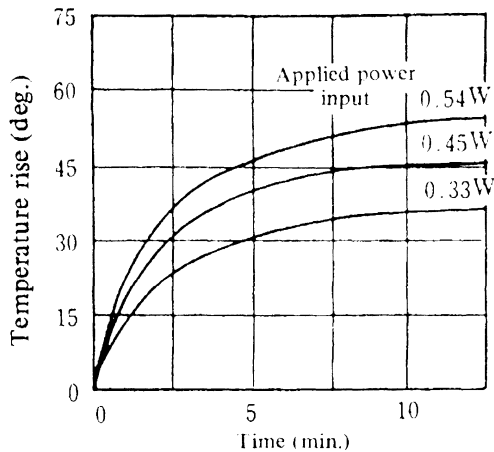


Fig. 2.5 Coil temperature rise (Time characteristics, MZ Relay)

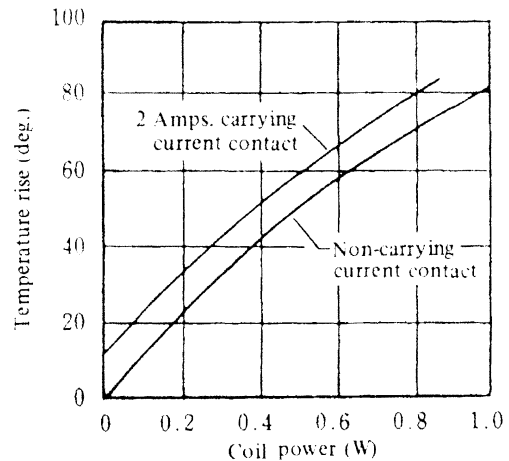


Fig. 2.6 Coil temperature rise (Power characteristics, MZ Relay)

(2) Operating temperature range

The operating temperature range of relay is defined on the basis of the following two factors:

One is the relationship between the allowable applying temperature range of contact spring and organic insulation materials used in magnet coil wire, spool, etc. and their temperature rise of the effect of currents of winding and contact spring. The other is the boundary temperature, beyond which the relays don't operate due to increase in their coil resistance caused by temperature rise.

Concerning the former factor, the relationship between the kind of magnet wire insulation material and the allowable temperature is shown in Table 2.4. The magnet wire used in the general relays is the polyurethane wire class E with an allowable temperature of 120°C. For the relays requiring on allowable temperature higher than that, other adequate kinds of wire should be selected.

Table 2.4 Type of insulation materials and permissible temperature

| Type of insulation | Maximum permissible temperature (°C) | Coil insulating material |
|--------------------|--------------------------------------|-----------------------------|
| Type Y | 90 | |
| Type A | 105 | Polyvinyl formal oil enamel |
| Type E | 120 | Polyurethane |
| Type B | 130 | Polyester |
| Type F | 155 | Polyester (Special) |
| Type H | 180 | Polyimide |
| Type C | Above 180°C | |

As to the organic materials, the most popular material is the glass fiber reinforced polycarbonate or PBT, whose allowable temperature is about 120/130°C. The contact springs and contacts have also a proper allowable temperature and an allowable current depending on their dimensions, respectively. The currents larger than that cause degradation in properties. The upper limit of operating temperature based on these materials varies depending on the level of applied power input. In the lower temperature range, usually used relays are applicable with no troubles up to -40°C.

ENGINEERING REFERENCE

2.1.4.5 Hot coil and cool coil

Sometimes occurs such a case where, after a relay coil is energized at an ambient temperature T ($^{\circ}\text{C}$), the coil is allowed to be heated up and, upon reaching a temp. of $(T + t)$ ($^{\circ}\text{C}$), the coil is deenergized and the relay is immediately actuated to enter into operation. In this case, however, if the coil is allowed to be heated up to an extremely high temp., it may occur that the relay does not start operation when a voltage equivalent to that taken just before the coil is energized at T ($^{\circ}\text{C}$) is applied.

This is, in fact, caused by the increase in coil resistance so that an additional voltage is required to have the relay operated securely.

A coil status, such as described above, observed just after being deenergized upon reaching a significantly high temperature by energizing is called "hot coil". On the other hand, a coil status standing at a temperature similar to ambient temperature is called "cool coil". The pickup voltage of hot coil is higher than that of cool coil.

2.1.4.6 Ambient temperature and allowable winding voltage

(1) Maximum and minimum allowable voltage graph

The current flow through magnet coil, as described in Section 2.1.4.4 (1), works to raise the temperature of winding; therefore, for the practical use, the specification of coil's maximum allowable temperature range is needed, which leads, in turn, to specification of the max. allowable voltage and, in its turn, max. allowable power, which depend, however on ambient temperature, too.

With increase in ambient temperature, the coil temperature rise shifts to higher levels so that the relay must operate voltage is raised as well.

As a result, the coil's minimum allowable voltage and, in its turn, allowable minimum power are also required to be raised. The graphs representing these interrelations are collected in the catalogue: "The characteristics of ambient temperature vs max. allowable voltage and operating voltage".

The max. and min. allowable voltages can be calculated by use of these graphs.

As an example, the interrelations of LZ type relay shown in Fig. 2.7 will be described below.

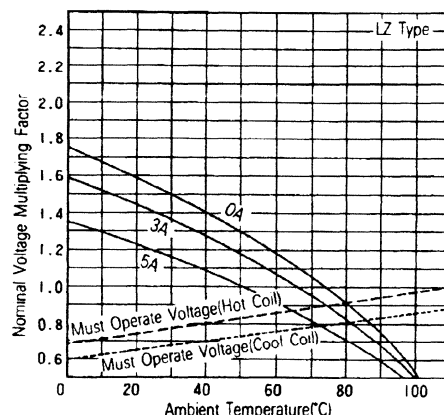


Fig. 2.7 Ambient temperature & maximum allowable voltage (LZ Relay)

The abscissa represents ambient temperature and the ordinate ratio of applied voltage to nominal one.

The curves running from the upper left to the lower right show the relay maximum permissible voltage at each ambient temperature for three types of contacts, no load contact, 3 A load contact and 5 A load contact. The relay must be used below the voltage values shown in these curves at each ambient temperature. Furthermore, the two broken lines running from the lower left to upper right show minimum responding voltages for cold and hot coils at each ambient temperature. For relay setting, voltages greater than those indicated by these broken lines must be supplied to the coil at each temperature. As a result, the relay must be used within the range bounded by one of the three curves (according to whether relay has an exciting contact or not) and the two broken lines.

(2) Long-term continuous energizing

The relays used in power supply monitoring circuit and warning circuit are sometimes placed in an energized state for a long period of time with no interruption. Continued holding at a high temperature for a long time may cause degradation in quality of material, leading to shortening of life.

For such cases, the following countermeasures are recommended:

- 1) Selection of as low ambient temperature as capable
- 2) Use of a high sensitivity relay

The power demand of this type relay is small in general.

ENGINEERING REFERENCE

- 3) Connection of a resistance to relay winding in series. However, securing of operate current is required. This method is applicable when the operate voltage is enough small than supply voltage.
- 4) Connection of a zener diode to relay winding in series. The purpose is the same as that of 3).
- 5) Connection of a circuit composed of parallel connection of a pair of capacitor and resistance to relay winding in series. The charging current into capacitor is used when relay is operate, and the current flowing via resistance used to hold the operation after operate. Be careful that the relay sometimes does not function if, after restoring, set again before capacitor finishes discharging.
- 6) Use of latching relay. No need of energizing after operation is finished. No heat generation. Effective for power saving.

2.1.4.7 Operate time and release time

The operate time varies depending on the applied power to coil and the resistance of winding circuit. Fig. 2.8 shows an example of the operate time vs applied power.

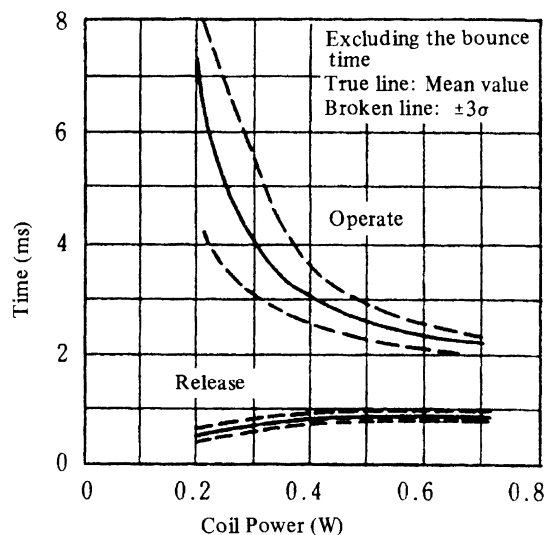


Fig. 2.8 Operate and release time

The release time, which is shown together in Fig. 2.8, varies just a little with change in applied power.

There are strict specifications for operate and release times in the sector of communication apparatuses such as tele phone exchange equipment while the general power relays do not demand very severe operating time.

As to the contact bounce of relays, its duration time depends virtually on the kind and structure of relay. It is relatively small in the recent sub-miniature relays.

Usually the contact bounce is not included in operate and release time but, if required to be included, the description of that effect is attached.

The testing procedures for operate, release and contact bounce times are specified in IEC Publication 255-7 Electrical Relays Part 7.

2.1.4.8 Dielectric strength and insulation resistance

(1) Characteristics of relay

As to specifications of dielectric strength and insulation resistance of relays, the items to be prescribed are as follows:

- 1) Between open contacts
- 2) Between adjacent two contact pairs, for each adjacent contact pair, when several contact units are mounted in one relay.
- 3) Between coil terminal and contact terminal
- 4) Between ground terminal and coil terminals as well as ground terminal and contact terminals

The fact that all the abovementioned items concerning dielectric strength and insulation resistance are ranked at a high level, respectively, is one of the features of the relay.

The dielectric strength between the terminals mentioned in the above items 1) to 4) are the very mandatory items specified in FCC (Federal Communications Commission, U.S.A.) Standards, Part 68. The types of relays complying with this Standards are listed in the catalog.

ENGINEERING REFERENCE

To be worthy of special mention, some relays are equipped with a contact with as high a dielectric strength between coil and contact terminals as able to withstand a impulse voltage of around 10 kV, which therefore, if used in combination with a semiconductor, can even protect the semiconductor from a lightning surge voltage.

As for the evaluation of dielectric strength, there are two kinds of testing method: test by means of a sine wave voltage of 50 or 60 Hz and a pulse voltage similar to lightning surge voltage. Those methods are called dielectric test (commercial frequency dielectric strength) and impulse voltage test, respectively.

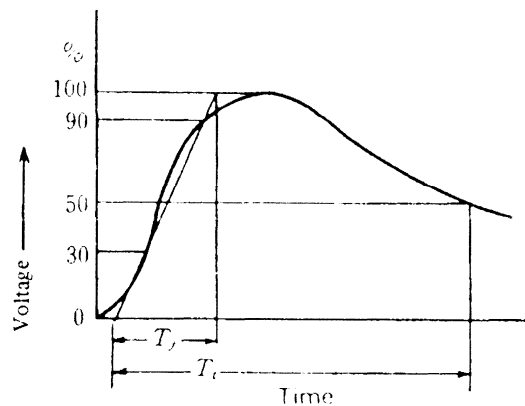
(2) Dielectric strength at commercial frequency

This is the voltage that the relay must be able to withstand without dielectric breakdown when a specified AC voltage (50/60 Hz) is applied for 1 min. (Japanese Industrial Standards permits, as a substitution, to apply a test voltage of 110% of the 1-min. voltage for 1 sec.) between the terminals mentioned in Item (1), where the standard maximum leak current is 5 mA while there is an exception of 1 mA for special use. The format of test conditions to be described in catalog, etc. is, for instance, "Min. 1,000 VAC 1 min."

(3) Dielectric strength at impulse voltage

This is the peak value that the relay must be able to withstand without dielectric breakdown when, based on the testing method specified in IEC Publication 255-5 Electrical Relays Part 5, a specified pulse voltage with $T_r = 1.2 \mu\text{s}$, $T_f = 50 \mu\text{s}$ in a wave form as shown in Fig. 2.9 is applied between the terminals mentioned in Item (1).

Take care, however, that the wave form of impulse voltage specified in FCC Standards is $10 \times 160 \mu\text{s}$. An expression of $(1.2 \times 50) \mu\text{s}$ described in the column of surge strength in catalog indicates the time lengths T_r and T_f in a pulse wave diagram as shown in Fig. 2.9.



| Kinds of wave form | T_r | T_f |
|--------------------|----------------------------|----------------------------|
| A | $1.2 \mu\text{s} \pm 30\%$ | $50 \mu\text{s} \pm 20\%$ |
| B | $10 \mu\text{s} \pm 30\%$ | $160 \mu\text{s} \pm 20\%$ |
| C | $10 \mu\text{s} \pm 30\%$ | $700 \mu\text{s} \pm 20\%$ |
| D | $100 \mu\text{s} \pm 30\%$ | $700 \mu\text{s} \pm 20\%$ |

Fig. 2.9 Testing wave form of surge-resistance voltage

(4) Insulation resistance

This is the insulation resistance between the specified conductors insulated with insulating material, and the values as reliable as passing the test conducted by applying 500 VDC between the terminals mentioned in Item (1) are listed in the catalog.

This value changes depending on temperature and humidity, being lowered with increase in humidity. The values listed in catalog are those at standard conditions (temp.: $20 \pm 15^\circ\text{C}$, rel. humid.: $65 \pm 15\%$). This conditions are also listed together in catalog. General relays have an insulation resistance of at least 1,000 M Ω .

ENGINEERING REFERENCE

2.1.4.9 Characteristics for environments

(1) Ambient temperature and humidity

The tests of general relays are conducted under the following test conditions in various environments such as at high humidities and high/low temperatures.

These tests are based on the testing procedure specified in both IEC Publication 255-7 Electrical Relays Part 7 and Japanese Industrial Standards JIS C 5442.

1) Cold

No abnormality is permitted when contact resistance, operate and release voltages, insulation resistance, etc. are tested after sample relays are kept in a thermostatic chamber of $-40 \pm 3^\circ\text{C}$ for 1,000 consecutive hours without energization.

2) Heating

No abnormality is permitted when contact resistance, operate and release voltages and insulation resistance, etc. are tested after sample relays are kept in a thermostatic chamber of $85 \pm 2^\circ\text{C}$ for 1,000 consecutive hours without energization.

3) Thermal shock

No abnormality including mechanical damage is permitted when insulation resistance, dielectric strength, operate and release voltages, operate and release times, and contact resistance are tested after sample relays are subjected to 100 cycles of heat shock loop of $-40^\circ\text{C} \times 1 \text{ h} + 20^\circ\text{C} \times 5 \text{ minutes max.} + 85^\circ\text{C} \times 1 \text{ h} + 20^\circ\text{C} \times 5 \text{ minutes max.}$

4) Damp heat

No abnormality is permitted when contact resistance, operate and release voltages, operate and release times, dielectric strength and insulation resistance are tested after sample relays are held at a temperature of $40 \pm 2^\circ\text{C}$ and a humidity within 90 to 95% for 1,000 hours.

5) Temperature-humidity loop test

No abnormality is permitted when contact resistance, operate and release voltages, operate and release times, dielectric strength and insulation resistance are tested after sample relays are subjected to 10 cycles of a specified loop of temperature/humidity combination of $65^\circ\text{C} \times 90 \text{ to } 98\% + 25^\circ\text{C} \times 80 \text{ to } 98\% + -10^\circ\text{C}$.

(2) Ambient atmosphere

Dust, oil mists, organic and inorganic gases produce adverse effects on relays such as increase in contact resistance and contact erosion.

Therefore, careful selection of relays is required for use in an atmosphere containing plenty of dust and/or gases and, if for use in an extremely contaminated atmosphere, sealed type relays are recommended.

However, even a plastic-sealed relay may cause an operational malfunction as nitric acid produced by nitrogen oxides generated by arcing and moisture causes damage to metal parts when the relay opens and closes under load, which is apt to produce arcing under condition of high humidity. In such a case, use a contact spark quenching device as shown in Fig. 2.3 in section 2.1.4.1.

(3) Vibration and shock

The use of relays is versatile, including relays used in rooms of buildings and those in circumstances subject to vibrational motion such as vehicles, vessels and aircrafts. Concerning the influences of vibration, the vibrational circumstances can be classified as shown in Table 2.5, which is the classification pattern by Japanese Industrial Standards JIS C 5002 (3). The troubles arising from these circumstances are the contact chattering caused by vibration and the mechanical damage to mechanism resulting from accumulated fatigue of parts caused by vibrations continued for a long period of time. The data concerning these two items are listed in each catalog.

The most significant cause of those troubles is the resonance of contact spring and other parts. These component parts are, however, sufficiently resistant, including resistance of mechanical damage, to general vibrational motion, i.e. the frequencies under that of resonance. The resonance frequencies of general relays are larger than 200 Hz.

Table 2.5 Classification of environments relating to vibration of sub-miniature relays (JIS C 5002)

| Symbol | Environment | Test vibrational frequency |
|--------|---|----------------------------|
| A | Mainly, environment of aircraft | 10 to 2,000Hz |
| B | Mainly, environments of land mobile equipment, marine and submarine vessels, which, however, limited to those subject to intensive movement | 10 to 500 Hz |
| C | Mainly, environments of land and marine transportation | 10 to 55 Hz |
| D | Environments of a little vibration | 10 to 55 Hz |

ENGINEERING REFERENCE

Like the effects of vibration, the troubles by mechanical shocks can be classified into two categories: malfunction due to chattering and mechanical damage due to severe shocks caused by violent movement/handling during transportation, cargo handling or other kinds of handling or accidental drop. The data concerning these two categories are listed in each catalogue like the handling of vibrational data. The acceleration of shock to the relay on a vehicle is approx. several m/s^2 in usual cases and in some special cases around $200 m/s^2$. In contrast, the accelerations as large as causing breakage of relay are far greater than those encountered in practical use.

According to drop tests from a height of 20 to 30 cm, usually terminals are subject to damage but the relay structure itself suffers no significant damage. However, a height of 50 cm or greater causes significant damage to the function of relay in most cases.

The testing procedures of vibration and shock resistances are specified in both IEC Publication 255-7 and JIS C 5442, in which forced vibrational and shock motions are applied in the 3 directions of x, y and z axes.

2.1.4.10 Relay reliability

(1) Modes of failures

The modes of failures of relay comprise those shown in Table 2.6, among which most failures are focused, in terms of frequency, on increase in contact resistance, poor electric continuity in contact and incapability of contact release.

Table 2.6 The mode of failures of relay

| Parts | Stress | | | Failure symptoms | Mode of failures |
|---|---------------------------------|---|---|--|--|
| | Status | Environment | Duration | | |
| Contact | Voltage, Current, Surge voltage | Temperature, Humidity, Dust, Gas, External vibration and External shock | Long duration without a break, Intermittent | <ul style="list-style-type: none"> • Transfer and wear of contact metal due to arc discharge • Weld and bridging of contact • Sticking of contact • Corrosion (oxidation, sulfurization, etc.) • Foreign matter (dust, etc.) • Deposits | <ul style="list-style-type: none"> • Poor release (welding, locking) • Poor contact • Increase in contact resistance • Noise • Change in operate/release voltage and operate/release time • Poor dielectric strength |
| Winding | Ditto | Ditto | Ditto | <ul style="list-style-type: none"> • Corrosion • Galvanic corrosion • Foreign matter (dust, etc.) • Voltage fluctuation • Vibration of lead wire | <ul style="list-style-type: none"> • Breakage of coil, short-circuit of coil • Burning of coil • Poor working release operation • Change in operate/release voltage • Change in operate/release time • Beat • Malfunction |
| Structural parts (Spring, sliding parts, insulations, other structural parts) | Ditto | Ditto Excessive external shock | Ditto | <ul style="list-style-type: none"> • Slip-off and wear of contact piece • Fatigue and creep of spring • Abnormal wear and loosening • Seize • Deterioration of organic material • Deposition of worn contact material powders • Corrosion and galvanic corrosion • Foreign matter (dust, etc.) | <ul style="list-style-type: none"> • Poor contact • Poor release operation • Change in operate/release voltage • Change in operate/release time • Degradation in insulation resistance • Poor dielectric strength |
| Enclosure | | Ditto Chemicals | Ditto | <ul style="list-style-type: none"> • Damage by external force • Change in chemical properties | <ul style="list-style-type: none"> • Damage |

(2) Reliability test

In this test, usually the switching operation is continuously repeated under a selected load and the increase in contact resistance and the contact welding failure are checked at each switching operation.

It is usual that the switching operation under as large a voltage and current as causing an intensive arc discharge works to result in cleaning of contact, thus a desirable low frequency of failures.

Under a load of 100 mA or less, the average failure rate over the whole life of contact is 10^{-6} to 10^{-10} at the 60% confidence level. Under a current load of 0.5 A or greater, decrease in the level of this rate is expected.

ENGINEERING REFERENCE

2.1.4.11 Life

(1) Mechanical life

In the mechanical endurance test, the relay performance is tested by continuous switching operation with no contact current load.

The major causes of life-end are the degradation in contact performance due to the deposition, on contact surface, of powders produced as the effect of wear of contact actuating card and stud or oxide of metal powders produced by the collision and rubbing motion of movable parts, and the change in operate and release voltages, contact gap and contact force.

(2) Electrical life

In the electrical life test, switching operation is repeated with a current load on contact. The life-end is when the relay has lost its proper function.

The causes of life-end are as follows:

1) Contact failure

- Reduction in contact force due to contact erosion.
- Deposition of powders caused by wear of organic materials of contact actuating card and stud on the contact surfaces.
- Deposition, on contact surfaces, of oxide of powders caused by collision and rubbing motion of movable parts and powders produced by erosion of contact metal.
- Deposition, on contact surfaces, of carbides produced by dissolution of organic gases adsorbed onto the contact surfaces.

2) Welding and bridging of contact

Welding of contact occur at the instant of contact closing by the effect of a large current arc discharge accompanied with bounce of contact. It also causes transfer of fused metal, leading to formation of a projection and, as a result, a bridging of contact.

3) Defective insulation

The deposition of scattered worn-contact metal powders on the surface of insulations causes reduction in their insulation resistance and dielectric strength. Also, the degradation in insulation resistance occurs due to local burning of insulations caused by a large amount of heat from arc discharge.

4) Others

The deviation of operate and release voltages, contact gap and contact force from their specified ranges effects life-end.

(3) Relationship between life and switched contact voltage/current

Generally, the contacts are provided with a form and dimensions safe enough to avoid erosion and transfer failures at least until the life-end listed in respective catalog.

Therefore, the electrical life listed in each catalog are those under the load conditions described together. If a contact load actually applied is smaller than that in catalog, the life of the contact will be extended. Examples of relationship between life and contact voltage/current are shown in Fig. 2.10 and 2.11, in which Fig. 2.10 is for DC load and Fig. 2.11 for AC load. The relationship of switched contact current vs life is expressed by a straight line with a gradient of about 45°.

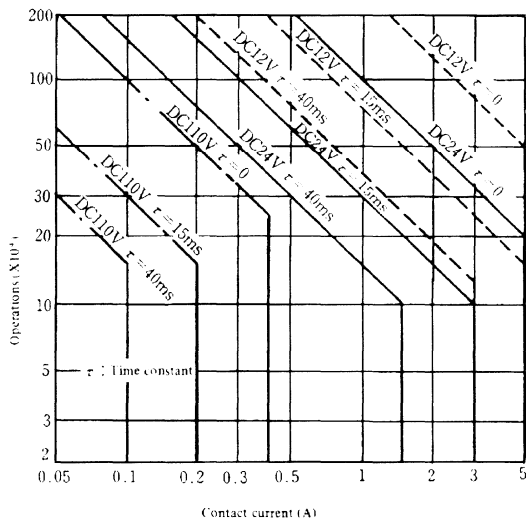


Fig. 2.10 Life curves (DC) (JY type, AgCdO contact)

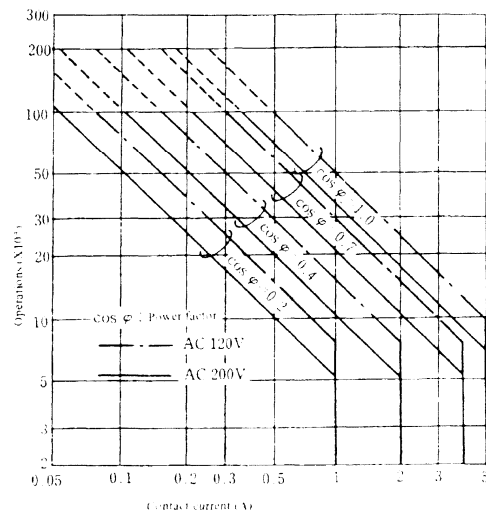


Fig. 2.11 Life curves (AC) (JY type, AgCdO contact)

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Both Figs show inductive loads, too, with the time constant or power factor and voltage of load as parameters. These figures indicate that:

- 1) The guarantee of a life (in number of switching operations) in inductive load equivalent to that in resistive load results in that the allowable voltage/current in inductive load is smaller than that in resistive load.
- 2) If assumed that the contact voltage/current in inductive load is the same as that of resistive load, the number of switching operations until the life-end is smaller in inductive load than that in resistive load.

The selection of relays having a life matching the requirements of equipment for use is important. If a specially large number of switching operations is required, the use of socket (receptacle) is useful because the change of relay is easy.

(4) Overload

Overload test is the contact load switching test for evaluation of surplus ability against the rated load of electromagnetic relay. This testing procedure is specified in both IEC Publication 255-7 and JIS C 5442.

2.1.5 Industrial standards and safety standards

2.1.5.1 Industrial standards

Among international standards concerning relays is IEC (International Electrotechnical Commission) Standard. Many of its publications, which are mentioned below, issued in parts including that of testing procedure are procurable separately. At present, a subcommittee of IEC is working to still more improve its quality, IEC Publication 255 "Electrical relays" series.

In Japan, there are many standards concerning relays including those which are given a title containing a word of 'relay'. The individual books of JIS (Japanese Industrial Standards) containing a word of relay in their title are as follows:

JIS C 4523 'Control Reed Relays'

JIS C 4530 'Hinge Type Electromagnetic Relays'

JIS C 5442 'Test Methods of Low Power Electromagnetic Relays for Industrial Control Circuits'

There are also other standards concerning relays issued from 'Nippon Electric Control Equipment Industry Association and other institutes or organizations.

2.1.5.2 Safety standards

Laws and regulations demand securing the safety of users from dangers such as electric shock and fire lying around household appliances and other consumer electric equipment or devices.

Major industrial countries across the world already have their own safety standards such as those under control of 'The Electrical Appliance and Material Control Law' in Japan, UL in U.S.A., CSA in Canada, VDE in Germany, SEMKO in North Europe and BS in GB, and the relays for use in consumer products such as household devices, automatic vending machines and business equipment are required to comply with each country's safety standard.

As to 'the Electrical Appliance and Material Control Law', the relay as an appliance is not included in either category of class-A and class-B electrical appliances of this Law so that the type approval by the Law does not apply to the relay itself. The Law, however, applies to each assembly with a relay as a component part so that the relay must be equipped with as high a level of technology as meeting the technical level specified in that Law.

The major items to be evaluated by the Law are as follows:

- 1) Temperatures of contact and coil
- 2) Dielectric strength between conductors
- 3) Insulation resistance between conductors
- 4) Insulating distance between conductors (space distance and creeping distance)

In U.S.A., consumer products must conform to UL (Under Writer's Laboratories Inc.) standards so that the relays intended for rule in U.S.A. are required to acquire the approval of UL. The type of relay authorized by UL is announced publicly for convenience of users.

For evaluation of technical level, besides the test items specified in the abovementioned Law, there are standards for material test, electric endurance test and over load test. In UL standards, test conditions are different among categories. The TV rating is a good example. It was established in 1970, making an event of TV fire an occasion. This TV rating is a very severe one, demanding for the outside materials to have both the self extinguishing and arc-proof properties and for the electric endurance test and over load test to use a huge inrush current as a test load, where an inrush current is specified for each rated current. The products approved after the testing based on this TV rating are permitted to carry a mark of TV-5 and a display of approved current level.

CSA (Canadian Standards Association) is given by a Canadian law the authority of establishment of standards and qualification of products. The products intended for export to Canada are required to be approved by CSA and carry the mark of 'CSA'. The technical level demanded by CSA is almost the same as that by UL. The CSA TV rating has been enforced since 1971.

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The UL and CSA TV rating has a system of approval ranking. The rank of each type of our relay is shown in Table 2.7.

Table 2.7 TV rating recognized relay type

| TV Rating | TV-3 | TV-5 | TV-8 | TV-10 | TV-15 |
|------------|------|----------------|------|-------|-------|
| Relay type | VB | VG VS VR | VS | VH | VF |

In Germany, VDE (Verband Deutschen Elektrotechniker e.v.) has the authority concerning safety. German safety standards are rated high worldwide. In Germany, it is established by a law that the products approved by VDE can receive immunity from responsibility even if they are a cause of an electric shock or fire accident. Other countries' standards are also similar to the above ones in character.

2.2 RECOMMENDATION AND PRECAUTION

2.2.1 Silicone compound should be avoided

Products containing silicon are widely used as silicone rubber, insulation material, paint, etc., since they have excellent electric insulation, heat and cold resistances. If, however, any material containing silicon is used in the neighborhood of relay, the silicon gas emitted from that material penetrates into the interior of relay and the silicon oxides produced by the effect of arc discharge at contact are deposited on the contact surfaces, which brings, after all, contact failures. Thus, be sure to keep silicone compounds apart from relays. If the use of silicone compound is inevitable, use a plastic-sealed relay.

2.2.2 Strong magnetic field can cause disorder of operate and release voltages

The strong magnetic field generated from the equipment with electro-magnetic appliance such as transformer and speaker, arranged near a high sensitivity or polarized relay, can cause disorder in operate and release voltages of the relay. In such a case, suitable measures such as magnetic shielding or selection of adequate location/orientation in arrangement of relay should be taken to protect relays from malfunctions.

2.2.3 Guide for connection of load

• AC circuit is better for switching of load:

Generally, in DC load that never takes zero potential unlike AC load, the once generated arc discharge lasts for a relatively long time and the load-cutting control capacity is smaller compared with that in AC load. Moreover, in DC load, the contact life shortening events caused by contact metal transfer or the like occurs more often.

Therefore, if both of AC and DC circuits are available for switching of load as shown in an example of Fig. 2.12, the switching by AC circuit is desirable from the standpoint of life.

• Parallel connection of loads and contacts:

Loads and contacts should be connected with the same polarity of their power sources arranged on the same side as shown in Fig. 2.13 (a). If, to the contrary, reversed between them as shown in Fig. 2.13 (b), there is a fear of short-circuit between the power sources of adjacent two contacts. If the reversed arrangement is inevitable, use a multi-contact relay such as FRL-230 type relay to secure a larger distance between two adjacent contacts by arranging a dead contact between them.

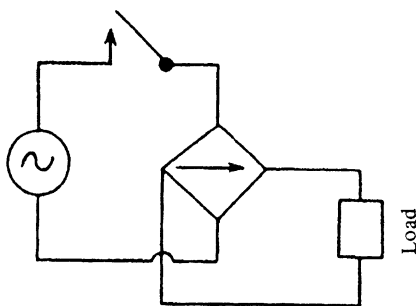


Fig. 2.12 AC circuit is better for switching of load

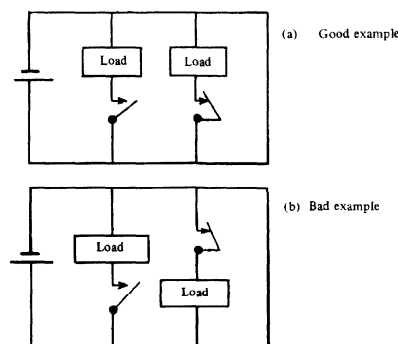


Fig. 2.13 Parallel connection of load and contacts

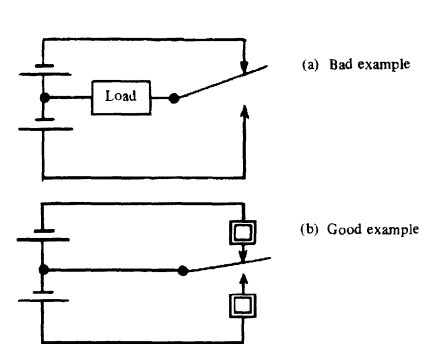


Fig. 2.14 Load share and division

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• Division of load:

If a load is shared in a manner as shown in Fig. 2.14 (a), an arc discharge may cause a short-circuit between power sources, leading to burning of contact. The recommendations for such a case is division of load, as shown in Fig. 2.14 (b), or insertion of a resistance.

• Short-circuit between contacts:

At a transfer contact, in principle, the make contact is closed after the break contact is opened. However, there is a fear of short-circuit between make and break contact due to arc discharge. However, in a circuit as shown in Fig. 2.15 (a), there is a risk of formation of such a short circuit as a loop of a-b-c if an event of 3-point contact occurs at c. In the same way, in Fig. 2.15 (b), a short circuit as a loop of d-e-f if 3-point contact occurs at f. Be sure to avoid such connections.

• Polarity switching in motor:

When change of rotary direction of a running motor is attempted, such a connection as shown in Fig. 2.16 (a) will make the power supply circuit shorted in the cause of ionization of the air in the vicinity of contact by the effect of arc discharge at contact, resulting in damage to contact.

It is, therefore, necessary for reversing the direction of rotation to adopt a circuit as shown in Fig. 2.16 (b) so as not to be switched before arc is extinguished.

It is desirable to avoid switching of two extremely different loads, such as a combination of large and micro current loads, in the same relay. Products such as carbon powders produced when a large current load is switched can be deposited on the contact faces of micro current load switching contact, leading, after all, to contact failures.

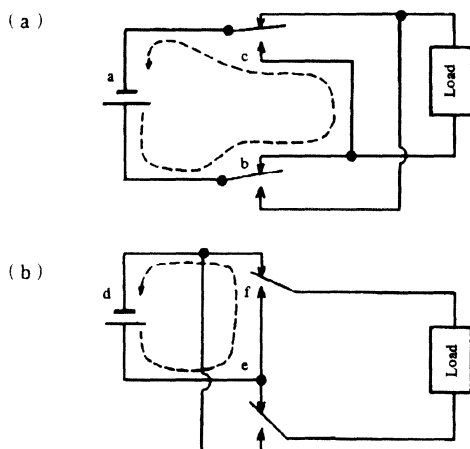


Fig. 2.15 Short-circuit between contacts

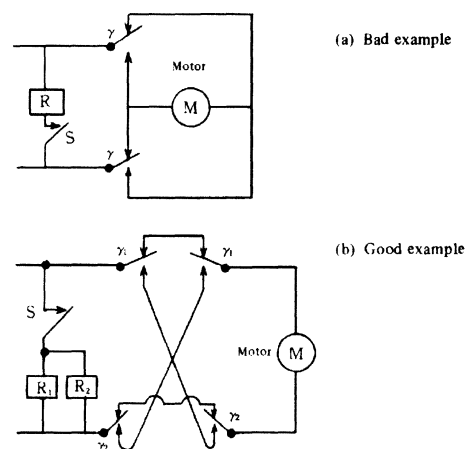


Fig. 2.16 Polarity switching in motor

2.2.4 Precautions for mounting of relay

2.2.4.1 Schematics and PC board mounting hole layout

Schematics and PC board mounting hole layout are inserted in the catalog for the instruction of printed circuit board relays, which are those viewed from the back side of printed circuit board (the side opposite to the relay mounted side) for through hole relays, and are those viewed from the top side of printed circuit board for surface mount relays.

2.2.4.2 How to use socket

- 1) The relay should be inserted into or removed from receptacle always perpendicularly to the face of receptacle. If not perpendicular but aslant, terminals may be bent, causing poor contact with receptacle and thus its contact failures.
- 2) If considered a fear of loosening in coupled relay and receptacle, be sure to use a fixture attached to the receptacle.
- 3) Be sure to deenergize the receptacle before insertion or removing of relay to avoid the danger of electric shock and damage to equipment.
- 4) The use of receptacle is helpful for maintenance of relay. Be careful, however, not to change the type or kind of relay by mistake when replacement is required.

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2.2.4.3 Others

- 1) Be careful that a large shock, e.g., caused by accidental drop may degrade the performance of relay. If having dropped accidentally, be sure to check for performance before mounting.
- 2) Be careful that machining of panel with a relay mounted on it can cause chips to enter the interior of relay, leading to malfunction on contact failure. The same troubles may occur if holes are drilled in a printed circuit board with a relay mounted on it.

2.2.5 Transistor driver

2.2.5.1 Relay driver

Fig. 2.17 shows a standard circuit for relay driver used transistor.

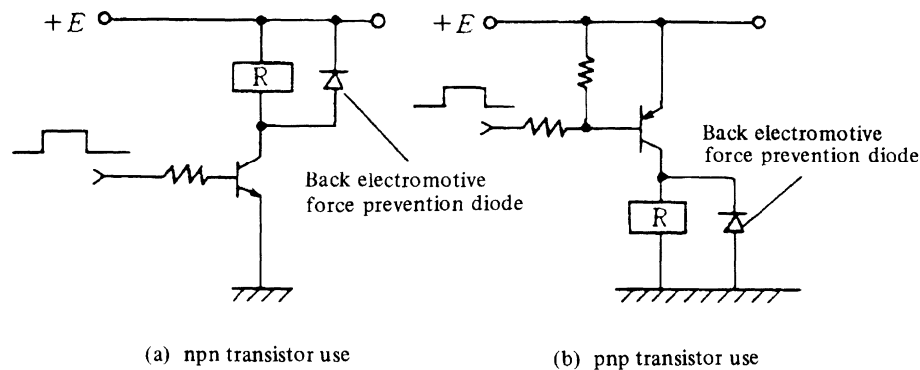


Fig. 2.17 Standard circuit for relay driver used transistor

2.2.5.2 How to select transistor

- (1) Determination of voltage and current to be applied to coil of relay
 - 1) See the catalog and select the type of relay and the nominal voltage of its coil to be used.
 - 2) Considering the allowable fluctuation in power supply, determine a maximum voltage and current to be applied to the coil at a max. ambient temperature, which constitute the worst conditions of allowable collector loss of transistor.
 - 3) Determine a max. coil current at the lowest ambient temperature, which is the max. level of collector current.
 - 4) Assure that the voltage to be applied to coil at the highest ambient temperature exceeds the operate voltage of the relay.
- (2) Selection of transistor
 - 1) The dielectric strength of transistor must be at least two times the voltage of power source.
 - 2) Select a switching transistor with a collector current at least two times^{*)} as large as the coil current at max. conditions.
*): Safety factor
 - 3) After determination of collector current is completed, determine the base current. The base current is required to be large enough to permit the use of transistor within an area of saturated interval between collector and emitter.
 - 4) Determine the collector loss at worst conditions. Add the base loss to this loss to obtain the total transistor loss. Assure that the value obtained falls within an allowable range in the total loss vs ambient temperature characteristic with a sufficient reserve room in that range.

2.2.5.3 Back electromotive force prevention element

A sudden shutoff of coil current causes a sharp high-voltage pulse. If this voltage exceeds the dielectric strength of the transistor for relay drive, the transistor may suffer damage or degradation in performance. Therefore, the insertion of a back electromotive force preventing element in parallel with magnet coil, as shown in Fig. 2.17 is required. Diode, a combination of diode and zener diode, or varistor is used as a protector element in practice. As to the ratings of these elements, the average current should be the same as magnet coil current and a safe level of maximum reverse voltage is around 3 times the power source voltage.

2.2.5.4 Precautions for transistor driver

- (1) Relay drive current wave form
A large onset or downset time length in relay drive current wave causes an unstable operate or release, resulting in shortening of contact life.
To settle such a problem, insertion of a schmidt circuit in the fore stage of circuit as shown in Fig. 2.18 is recommended to reform the wave shape.

(2) Dark current

If such a circuit as shown in Fig. 2.19 (a) is selected in order to pick out another signal at the time when relay begins operation, a small dark current will remain in the relay coil even if the transistor 'T₁' is turned off. A dark current remaining in relay coil can disturb restoration of relay and cause degradation in vibration and shock resistances. A modified circuit as shown in Fig. 2.19 (b) is recommended to settle such a problem.

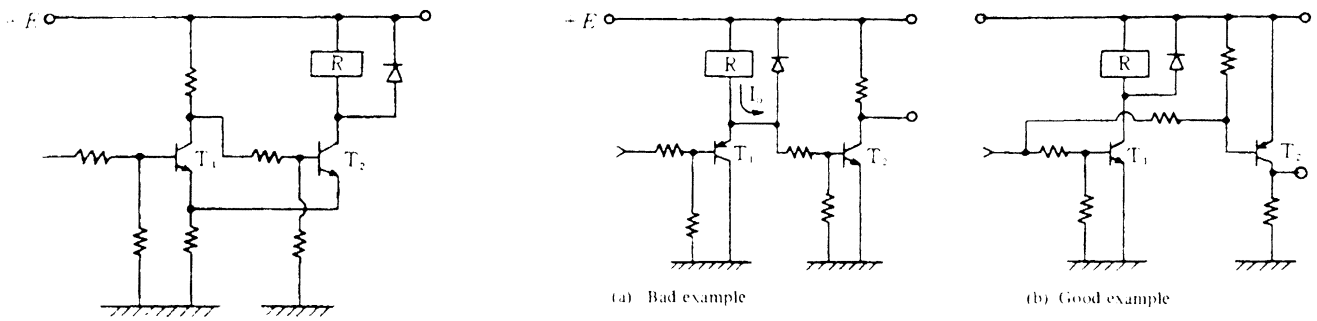


Fig. 2.18 Schmidt circuit to reform wave shape

Fig. 2.19 Circuit for protect dark current

2.2.6 Check of contact for synchronization with AC load phase

If a half-wave rectified current is used as a relay energizing current when a contact load comprises an AC load, the timing of operate and release of relay is liable to synchronize with the phase of load, as shown in Fig. 2.20. In some relays, their contacts switch the AC load in the vicinity of a peak level of that load current and in some other relays only in the vicinity of zero level so that, at shutdown of current load, a large current arc discharge lasts for a long time in some relays but not in other relays. thus resulting in large dispersion of life among relays.

Even an full-wave rectification with no smoothing capacitor can cause a similar phenomenon so that it is recommended to use as large a capacity of smoothing capacitor as capable to reduce the pulsation.

Be careful that a similar phenomenon occurs if the switching operation of contact synchronizes with the AC load phase even if a energize power source with a small level of pulsation is used.

A random-phased switching operation is desirable. By the way, if synchronization is permitted, the contact switching timing should be adjusted so as to coincide with the timing of AC load just crossing zero level; if so, a long life of relay will be expected.

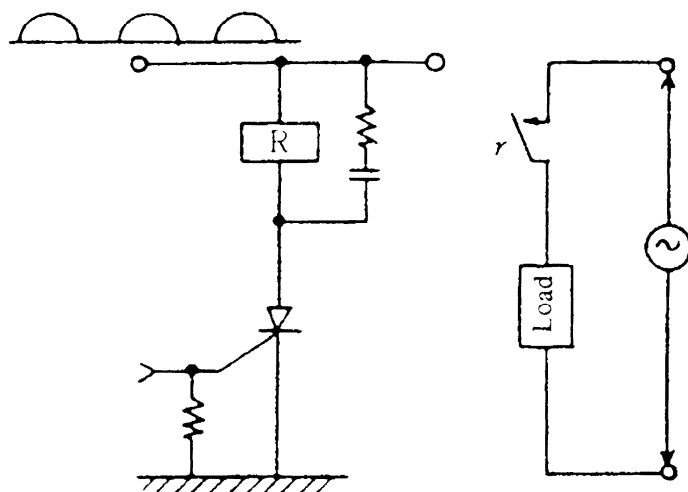


Fig. 2.20 Check of contact for synchronization with AC load phase

ENGINEERING REFERENCE

2.2.7 Usage of latching relay

2.2.7.1 Example of latching relay driver

Fig. 2.21 shows an example of latching relay driver, in which an AC half-wave is used for drive of a non-polarized latching relay.

In Fig. 2.21, if an optimum level of resistance is given to current limiter resistances R_1 and R_2 , respectively; this circuit can be used as a drive circuit for one-coil type polarized latching relay and, if an independent coil is provided to each of 'I₁-coil' and 'I₂-coil' in the Figure, this circuit can be used as a drive circuit for two-coil type latching relay.

In this circuit, a half-wave alternate current is used for the operation and release of relay; when transistor Tr_1 is turned on, a current I_1 flows to operate the relay and, when transistor Tr_2 on, a backward current I_2 flows through an magnet coil to release the relay. Here, R_1 and R_2 are current limiters, i.e., they control the current level in a non-polarized relay so as to be larger than a release current and lower than a reoperating current.

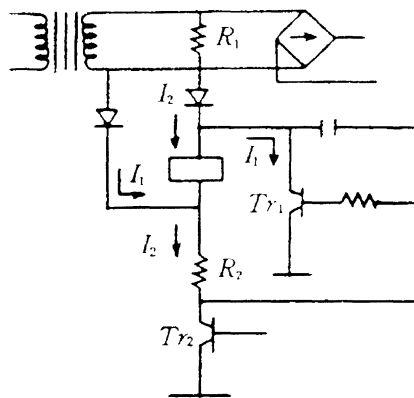


Fig. 2.21 Example of latching relay driver

2.2.7.2 Precautions for connection of latching relay winding

- 1) For winding connection of latching relay, be careful to have the polarity comply with the specification. Never have it reversed.
- 2) Avoid simultaneous application of voltage to set and reset coils. (In case of 2-coils latching relay.)
- 3) For parallel connection of coils, be sure to insert a diode.

For connection of more than one set coils or reset coils, use diode(s), arranging in series with magnet coil in a manner as shown in Fig. 2.22, to avoid malfunctions caused by back electromotive forces among coils.

The situation (i.e. measures) is the same as the above when a set or reset coil is connected in parallel with an inductive load such as other relay coil, motor and transformer, as shown in Fig. 2.23.

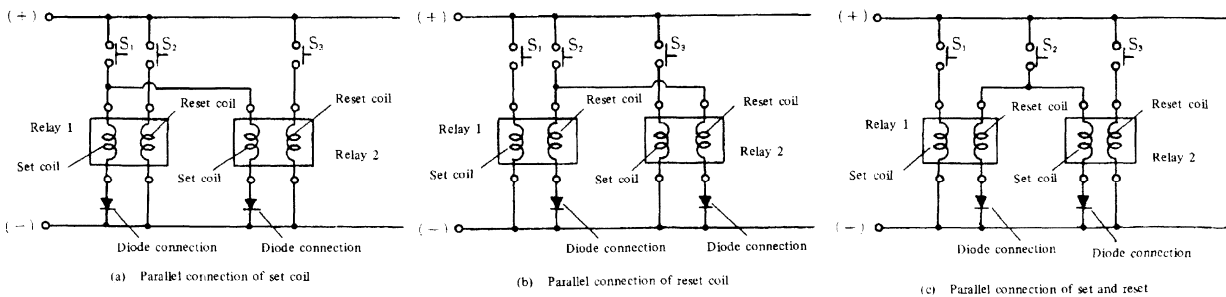


Fig. 2.22 Parallel connection of latching relay winding

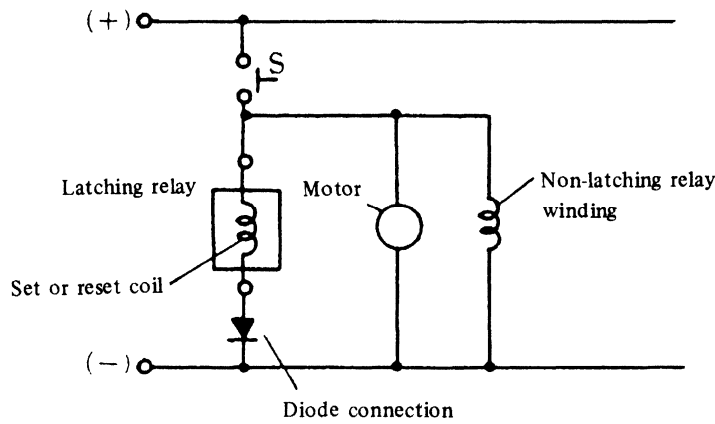


Fig. 2.23 Parallel connection of latching relay winding and inductive load

2.2.7.3 Other precautions

- 1) As to the widths and voltages of drive pulses for operate and release of latching relays, refer to appropriate catalogs.
- 2) For use in environments filled with plenty of iron or other magnetic powders, dust, etc., select adequate sealed type relays.
- 3) For use in particularly intensive magnetic field, check for the effect by using the very relay set you attempt to use. As to interrelay distances among a number of densely mounted relays, refer to the paragraph of 'Magnetic interference' in 2.2.8.1 (1) 2).
- 4) When any appliance or equipment equipped with a latching relay is completed of a final product, the first energizing of the product should be conducted with the latching relay circuit in reset state.

2.2.8 Mounting of relay on printed circuit board

2.2.8.1 Mounting of relay on printed circuit board and designing of circuit pattern

(1) High density mounting of numerous relays

1) Temperature rise

Since the temperatures of densely mounted relays are raised by the effect of mutual intervention of the heat emitted from relay themselves, check for the operation of relay through a test of actually mounted relays in minimum interrelay distance.

Fig. 2.24 shows the results of a test example on temperature rise in the relays densely mounted together, in which nine relays were arranged in matrix of 3×3 and the temperature rise of a relay positioned in the center of matrix were measured with the interrelay distances as the parameter.

Especially, care should be taken when a card rack with a lot of printed circuit boards layered is installed.

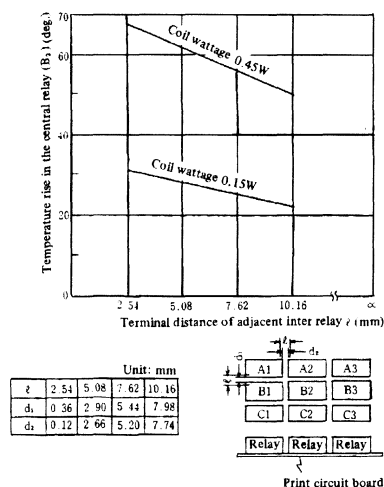


Fig. 2.24 Temperature rise in the relays densely mounted together (RY type)

ENGINEERING REFERENCE

2) Magnetic interference

The magnetic interference among densely mounted relays is also one of problems. An example of test results is shown in Fig. 2.25, in which the operate and release voltages of center relay in 9 densely mounted relays were measured under conditions of (a) to (g), that are expressed in percentage to those values in single mounting. Thus, the operate and release voltages, etc. are changed due to magnetic interference so that the minimum interrelay distance and mounting direction should be selected referring to the data described in the catalog for polarized relay.

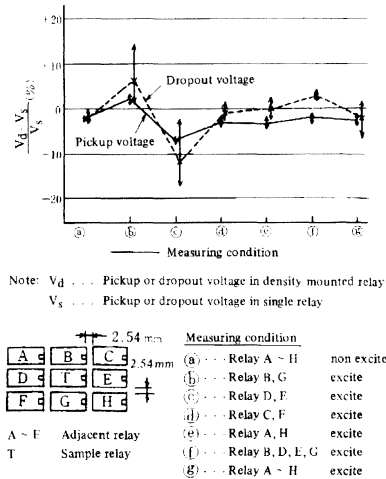


Fig. 2.25 The magnetic interference among densely mounted relays (RA type)

(2) Less-noise wiring pattern

Arrangement of any wiring pattern that must not be affected by the noise such as audio signal, in a manner as being located under the coil of relay should be avoided.

The recommendation, therefore, is the use of a relay with an exceptionally large distance between coil terminal and contact spring terminal.

A back electromotive force preventing element should be arranged as near the coil as capable to reduce the length of wiring pattern.

(3) Precautions for transportation of soldered printed circuit board

If a relay mounted and soldered onto a printed circuit board is lifted with the relay cover gripped, there is the possibility of the board slipping off by cover removing because the parts coupling the relay and cover are not always strong enough to be able to support the weight of board. Be sure to hold the board, not the relay.

Never remove the cover during transportation. If removed, the contact spring, etc. are subject to being caught by something, causing damage to the relay.

(4) Warp of printed circuit board

Avoid such assembling methods as causing warp of printed circuit board, which may lead to breakage of copper foil circuits and/or solder deposits, affecting the performance of relay.

2.2.8.2 Precautions for manual soldering

- 1) Use a soldering gun of 30 to 60 W, which should match the heat capacity of relay.
- 2) the soldering duration should be within 3 sec. for each attempt. An excessively long duration can cause separation of copper foil and damage to mold of relay, affecting the performance of relay.
- 3) An adequate temperature of soldering gun top end is 280° to 300°C. Never begin soldering before the gun is sufficiently heated up. A too low gun temperature often causes the flux contained in resin-mixed solder only to fuse and collect around a terminal, causing poor quality soldering.
- 4) It is recommended to lead the flux fumes into a duct or the like to prevent entry of the fumes into interior of relay.
- 5) As for coating of Cu foil with varnish, apply it limiting to the soldering side of printed circuit board only.

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2.2.8.3 Precautions for automatic soldering

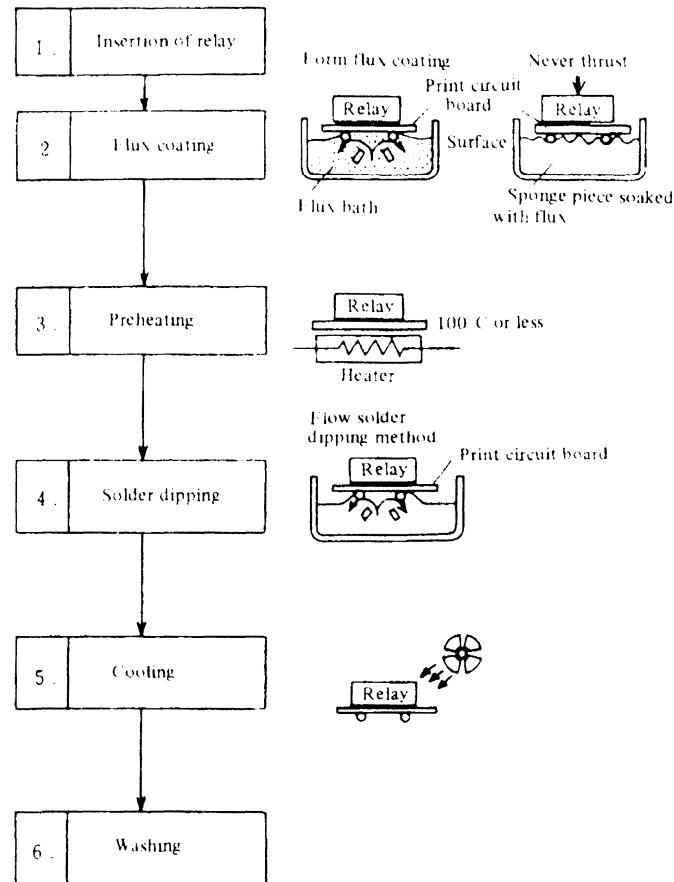


Fig. 2.26 Automatic soldering process

(1) Comply with the procedure represented in Fig. 2.26.

(2) Insertion of relay

A stick packaging system convenient for automatic mounting is prepared for some types of relays.

(3) Flux coating

- 1) Recommendable fluxes and solvents are those of rosin family and alcohol family, respectively. Alcohol is rather chemically inactive and rosin is not corrosive, needing no washing.
- 2) Using a foamed resin piece or the like, apply flux uniformly. Control the flux bath level so as to avoid flowing of flux over the printed circuit board surface to penetrate into the interior of relay.
- 3) If a sponge piece soaked with flux is used, never thrust it against printed circuit board because the squeezed-out flux may enter the interior of relay. Handling of sponge should be conducted gently. In addition, avoid direct dipping of printed circuit board in flux bath.

(4) Preheating

- 1) Be sure to make preheating after flux coating is completed. The preheating contributes to leveling the temperature distribution at dipping, resulting in good quality solder deposits, as well as to prevention of entry of flux into the interior of relay during soldering process.
- 2) The preheating temperature should be 100°C or less.

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(5) Solder dipping

- 1) Our recommendation is the adoption of flow solder dipping method represented in Fig. 2.26.
- 2) Use the solder complying with H60 or H63 specified in JIS Z 3282. (Ratio of Sn: Pb = 60:40 or 63:37).
- 3) An adequate solder bath temperature is 250°C ±5°C.
- 4) An adequate dipping time is within about 3 sec.
- 5) Control the solder bath level so as not to allow molten solder to flood the printed circuit board surface.
- 6) The oxide film covering the solder bath surface disturbs run-up of molten solder so that the use of oxide film formation preventing device (e.g. by oil film) or the action of frequent oxide film removal is required.

(6) Cooling

Use a blower to cool soldered assemblies immediately after completion of dip soldering process so as not to cause degradation in quality of printed circuit board, relay and other parts.

2.2.8.4 Precautions for washing (Cleaning)

There is no need of washing if rosin ester flux is used. If, however, any activated rosin ester flux is used, washing is mandatory because the activator contains corrosive chlorine and bromine.

If washing is inevitable, follow the advices presented below as to washing method and selection of washing solution so as to protect relay's cases from being damaged by washing solution as well as prevent penetration of washing solution into interior of relays:

(1) Washing solvent:

- Recommended solvent:
Alcohol based solvent, water
- Unrecommended solvent:
Chlorine-based solvents, Aromatic-based solvents

Refer to Table 2.8.

Table 2.8 Recommended, Unrecommended Solvents

| Recommended solvent | Unrecommended solvent |
|---|--|
| <ul style="list-style-type: none"> • Alcohol-base • Water | <ul style="list-style-type: none"> • Chlorine-base Trichloroethylene, Chloroethylene • Aromatic-base Thinner, Gasoline families (Benzene, Xylene, Acetone, etc.) |

(2) Washing procedure

1) Flux free type

- Wash the soldered side face only.
Gently wipe the surface. Be careful not to allow washing solution to flood the printed circuit board surface.
- The automatic or manual wiping motion for cleaning of soldered face by means of brush soaked with washing solution should be gentle and careful so that the washing solution containing dissolved flux is not scattered or driven through holes on the front side of printed circuit board.
- If a printed circuit board is placed directly on a sponge piece soaked with washing solution with the soldered face of board as the bottom side and, after holding for about 1 min., rubbed gently, flux will be removed easily.
- The cleaning by whole washing is not available to flux free type relays. If whole washing is required, use the following plastic sealed (washable) type relay.

2) Plastic sealed (washable) type relay

- Immersion cleaning is available to the plastic sealed type relay mounted on a printed circuit board (including plastic sealed type relays with small holes in their cases if these holes are sealed with adhesive tape). Such cleaning solvents as listed in Table 2.8 are recommended. Use of unrecommended solvents may damage the relay case.
- Avoid carrying out ultrasonic cleaning because there is a possibility that defects such as open coil and contact sticking may occur due to ultrasonic energy. However, if ultrasonic cleaning must be performed, contact us beforehand.

(3) Coating of printed circuit board

When spray coating is applied to a relay-mounted printed circuit board to improve the insulation resistance of circuit patterns as well as protect them from corrosion, the bodies of mounted relay and other parts should be covered with some adequate protector to protect them from damage by coating solution and prevent penetration of it into their interior; some coating solutions are chemically active enough to damage the relay case and/or cause contact failures, especially silicone compounds, which should never be used.