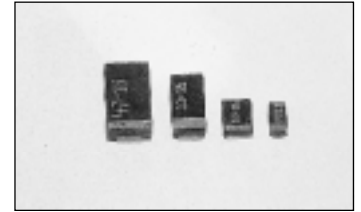


FEATURES

- MOLDED CONSTRUCTION FOR HIGH SOLDERING HEAT RESISTANCE
- NINE CASE SIZES WITH MANY NEW EXTENDED RANGE RATINGS
- BOTH FLOW AND REFLOW SOLDERING APPLICABLE
- TAPE AND REEL PACKAGING COMPATIBLE WITH AUTOMATIC PICK AND PLACE EQUIPMENT



SPECIFICATIONS AND PERFORMANCE CHARACTERISTICS

| Capacitance Range | 0.1μF to 470μF | | | | | | | | |
|--|--|-----|-----|---------|----|----|---------|----|----|
| Capacitance Tolerance | ±20%(M), ±10%(K) | | | | | | | | |
| Rated Voltage Range @ 85C (Vdc) | 2.5 | 4.0 | 6.3 | 10 | 16 | 20 | 25 | 35 | 50 |
| Surge Voltage Rating @ 85°C (Vdc) | 3.3 | 5.2 | 8.0 | 13 | 20 | 26 | 33 | 46 | 65 |
| Derated Voltage @ 125°C (Vdc) | 1.6 | 2.5 | 4.0 | 6.3 | 10 | 13 | 16 | 22 | 32 |
| Operating Temperature Range | -55°C to + 85°C (to +125°C With Derating) | | | | | | | | |
| Dissipation Factor | See Case Size and Specifications Table | | | | | | | | |
| Leakage Current @ +25°C (After 5 Minutes at Rated Voltage) | Not More Than 0.01 CV or 0.5μA, whichever is greater | | | | | | | | |
| Capacitance Change With Temperature | -55°C | | | +85°C | | | +125°C | | |
| A2, A, B2, B, C, D & E Case Size | ΔC -12% | | | ΔC ±12% | | | ΔC ±15% | | |
| J & P Case Size | ΔC -20% | | | ΔC ±20% | | | ΔC ±20% | | |
| Soldering Heat Resistance (+260°C for 5 Seconds) | ΔC ±5%* Max., LC = Less than initial specification. DF = Less than initial specification. | | | | | | | | |
| Moisture Resistance (500 hours; 90-95% RH @ 40°C) | ΔC ±5%* Max., LC = Less than initial specification. DF = 150% of initial specification | | | | | | | | |
| Temperature Cycling (5 cycles; -55°C ~ +125°C) | ΔC ±5%* Max, LC = Less than initial specification. DF = Less than initial specification | | | | | | | | |
| Load Life (At Rated Voltage) (2000 hours @ +85°C) | ΔC ±10%* Max, LC = 125% of initial specification. DF = Less than initial specification | | | | | | | | |
| Base Failure Rate (1.0Ω/Volt) | 1%/1000 hours at 60% confidence level. (+85°C) | | | | | | | | |

*±12% ~ ±15% for extended values, ±20% for J & P case size values

SURFACE MOUNT

RIPPLE CURRENT CORRECTION FACTOR:

| Ambient Temperature | +25°C | +55°C | +85°C | +105°C | +125°C |
|---------------------|-------|-------|-------|--------|--------|
| Correction Factor | 1.0 | 0.90 | 0.80 | 0.40 | 0.15 |

RIPPLE CURRENT/VOLTAGE RATINGS:

$$I_{max.} = \sqrt{\frac{Pd}{ESR}} \quad V_{max.} = Z \cdot \sqrt{\frac{Pd}{ESR}}$$

I_{max.} = Ripple Current rating (Arms)

Pd = Power dissipation (watt)

ESR = Equivalent series resistance (ohm)

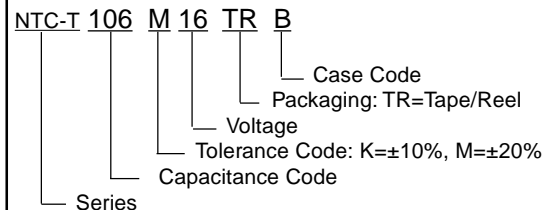
V_{max.} = Ripple voltage rating (Vrms)

Z = The capacitors impedance (ohm) = $\sqrt{(ESR)^2 + (XL-XC)^2}$

POWER DISSIPATION @ 25°C (FREE AIR) & EQUIVALENT SERIES INDUCTANCE (ESL)

| Case Code | Pd MAX. (W) | ESL (nH) |
|-----------|-------------|----------|
| P | 0.025 | 1.00 |
| A2 | 0.050 | 1.20 |
| A | 0.070 | 1.20 |
| B2 | 0.070 | 1.50 |
| B | 0.080 | 1.50 |
| C | 0.110 | 2.70 |
| D | 0.150 | 3.00 |
| E | 0.165 | 3.00 |

PART NUMBERING SYSTEM



STANDARD AND EXTENDED PRODUCT SPECIFICATIONS TABLE

* Extended Case Sizes
 Chart shows Case Size, Max Tan δ @ 120Hz/+20°C, Max. ESR @ 100Khz/+20°C

| Cap. (μF) | Code | Working Voltage (Vdc) | | | | | | | | |
|-----------|------|-------------------------------------|--|--|---|---|-------------------------------------|------------------------|-------------------------------------|-----------|
| | | 2.5 | 4.0 | 6.3 | 10 | 16 | 20 | 25 | 35 | 50 |
| 0.1 | 104 | | | | | | A2*6%/40Ω | | A 4%/18Ω | |
| 0.15 | 154 | | | | | | A2*6%/325Ω | | A 4%/18Ω | A 4%/19Ω |
| 0.22 | 224 | | | | | | A2*6%/35Ω | | A 4%/18Ω | B 4%/14Ω |
| 0.33 | 334 | | | | | P 10%/40Ω | A2*6%/30Ω | | A 4%/15Ω | B 4%/10Ω |
| 0.47 | 474 | | | | | P 10%/35Ω | A2*6%/27Ω | A 4%/14Ω | A*6%/12Ω B 4%/8.0Ω | B 4%/9.0Ω |
| 0.68 | 684 | | | | P 10%/25Ω | P 10%/25Ω A2*6%/25Ω | A2*6%/15Ω A 4%/12Ω | A*6%/10Ω | A*6%/9.0Ω B 4%/5.4Ω | C 4%/7.0Ω |
| 1.0 | 105 | | | P 10%/25Ω | P 10%/25Ω A2*8%/25Ω | J 10%/30Ω P 20%/25Ω A2*6%/16Ω A 4%/10Ω | A2*6%/13Ω A*6%/9.0Ω | A*6%/8.0Ω | A*6%/8.0Ω B 4%/4.8Ω | C 4%/5.5Ω |
| 1.5 | 155 | | P 10%/25Ω | P 10%/25Ω A2*8%/25Ω | J 20%/30Ω P 20%/25Ω A2*8%/20Ω A 4%/8.0Ω | A2*6%/13Ω A 4%/8.0Ω | A2*6%/13Ω A*6%/6.5Ω | A*6%/8.0Ω B 4%/4.6Ω | A*6%/8.0Ω B*6%/4.0Ω C 4%/3.0Ω | C 4%/4.0Ω |
| 2.2 | 225 | P 10%/25Ω | P 10%/25Ω A2*8%/25Ω | J 20%/20Ω P 20%/20Ω A2*8%/18Ω A 4%/8.0Ω | J 20%/30Ω P 20%/20Ω A2*8%/12Ω A 4%/7.0Ω | A2*6%/13Ω A*6%/6.0Ω | A*6%/6.0Ω B 4%/3.5Ω | A*6%/8.0Ω B*6%/4.0Ω | B*6%/4.2Ω C 4%/3.0Ω | D 4%/1.8Ω |
| 3.3 | 335 | P 10%/25Ω | P 20%/20Ω A2*8%/18Ω A 4%/8.0Ω | J 20%/20Ω P 20%/13Ω A2*8%/9.0Ω A 4%/7.5Ω | P 20%/20Ω A2*8%/12Ω A*8%/5.5Ω | A*6%/5.0Ω B 4%/3.5Ω | A*6%/5.0Ω B*6%/3.0Ω | B*6%/3.5Ω C 4%/2.5Ω | B*6%/4.0Ω C 4%/2.5Ω D 4%/2.0Ω | D 4%/1.4Ω |
| 4.7 | 475 | P 20%/20Ω A2*8%/18Ω | P 20%/12Ω A2*8%/10Ω A 4%/7.5Ω | J 20%/15Ω P 20%/12Ω A2*8%/7.5Ω A*8%/6.0Ω | P 20%/10Ω A2*8%/8.0Ω A*8%/5.0Ω B 4%/3.5Ω | A*6%/5.0Ω B*6%/3.0Ω | A*6%/5.0Ω B*6%/3.0Ω C 4%/2.4Ω | B*6%/3.0Ω C 4%/2.4Ω | C*6%2.2Ω D 4%/1.5Ω | D 4%/1.4Ω |
| 6.8 | 685 | P 20%/20Ω A2*8%/16Ω | J 20%/15Ω P 20%/12Ω A2*8%/8.0Ω A*8%/6.0Ω | P 20%/12Ω A2*8%/7.5Ω A*8%/5.0Ω B 6%/3.5Ω | A2 8%/5.0Ω A*8%/3.2Ω B2*8%/3.2Ω B*8%/2.5Ω C 6%/1.8Ω | A 8%/5.0Ω B2 8%/4.0Ω B*6%/2.4Ω C 6%/1.8Ω | B*6%/2.8Ω C 6%/1.9Ω | C*6%/1.9Ω D6%/1.4Ω | C*6%/1.9Ω D 6%/1.3Ω | |
| 10 | 106 | J 20%/12Ω P 20%/12Ω A2*8%/15Ω | J 20%/12Ω P 20%/12Ω A2*12%/8.0Ω A*8%/5.0Ω B 6%/3.5Ω | P 20%/12Ω A2*8%/10Ω A*8%/4.0Ω B 6%/3.0Ω | A2 8%/5.0Ω A*8%/3.2Ω B2*8%/3.2Ω B*8%/2.5Ω C 6%/1.8Ω | A 8%/5.0Ω B2 8%/4.0Ω B*6%/2.4Ω C 6%/1.8Ω | B*6%/2.5Ω C*6%/1.8Ω D 6%/1.3Ω | C*6%/1.8Ω D 6%/1.2Ω | D*6%/1.0Ω | |
| 15 | 156 | A2*12%/10Ω A*8%/5.0Ω | P 20%/ A2*12%/8.0Ω A*8%/4.0Ω B*8%/3.0Ω | A2 12%/ A*8%/3.5Ω B2*8%/3.5Ω B*8%/2.5Ω C 6%/1.8Ω | B2*8%/2.5Ω C 6%/1.8Ω | B2*6%/2.5Ω C*6%/1.8Ω D 6%/1.8Ω | C*6%/1.7Ω D 6%/0.8Ω | D*6%/1.0Ω | D*6%/0.9Ω | |
| 22 | 226 | A2*12%/10Ω A*8%/4.0Ω | P 20%/5.0Ω A2 12%/4.0Ω A*8%/3.5Ω B2*8%/3.5Ω B*8%/2.8Ω C 6%/1.8Ω | A*10%/4.5Ω B2*12%/4.5Ω B*8%/2.3Ω C 6%/1.8Ω | B2 12%/4.0Ω B*8%/2.4Ω C*8%/1.8Ω D 6%/1.5Ω | B*6%/2.5Ω C*6%/1.6Ω D 6%/0.8Ω | C*6%/1.5Ω D*6%/0.8Ω | D*6%/0.8Ω | | |

SURFACE MOUNT



STANDARD AND EXTENDED PRODUCT SPECIFICATIONS TABLE

* Extended Case Sizes
 Chart shows Case Size, Max Tan δ @ 120Hz/+20°C, Max. ESR @ 100KHz/+20°C

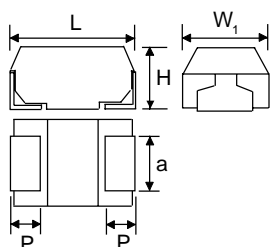
SURFACE MOUNT

| Cap. (μF) | Code | Working Voltage (Vdc) | | | | | | | | | |
|-----------|------|--|--|--|-------------------------------------|------------------------|-----------|----|----|----|--|
| | | 2.5 | 4.0 | 6.3 | 10 | 16 | 20 | 25 | 35 | 50 | |
| 33 | 336 | P 20%/5.0Ω A*8%/3.5Ω B2*8%/3.5Ω B*8%/3.0Ω | A*10%/4.5Ω B2*12%/4.5Ω B*8%/2.4Ω C 6%/1.8Ω | A 12%/5.0Ω B*8%/2.0Ω C*8%/1.8Ω D 6%/1.5Ω | B*8%/2.0Ω C*8%/1.6Ω D 6%/0.8Ω | C*6%/1.2Ω D*6%/0.8Ω | D*6%/0.8Ω | | | | |
| 47 | 476 | A*12%/4.5Ω B2*12%/4.5Ω B*8%/2.4Ω | A 12%/5.0Ω B2 12%/3.0Ω B*8%/2.0Ω C*8%/1.8Ω D 6%/1.2Ω | B2 12%/3.0Ω B*8%/2.0Ω C*8%/1.6Ω D 6%/0.8Ω | B 8%/3.0Ω C*8%/1.6Ω D*8%/0.8Ω | C*6%/1.2Ω D*6%/0.8Ω | D*6%/0.8Ω | | | | |
| 68 | 686 | A 18%/3.0Ω B*8%/2.0Ω | B2 15%/3.0Ω B*8%/2.0Ω C*8%/1.6Ω D 6%/0.8Ω | B*10%/1.8Ω C*8%/1.2Ω D*8%/0.8Ω | C*8%/1.2Ω D*8%/0.8Ω | D*6%/0.7Ω | | | | | |
| 100 | 107 | B2 18%/2.0Ω B*8%/2.0Ω | B*12%/2.0Ω C*8%/1.2Ω D*8%/0.8Ω | B 12%/1.2Ω C*10%/0.9Ω D*8%/0.8Ω | C 10%/1.2Ω D*8%/0.7Ω | D*10%/1.0Ω | | | | | |
| 150 | 157 | B*16%/5.0Ω | B 18%/2.0Ω C*10%/1.0 D*8%/0.7Ω | C 10%/1.2Ω D*8%/0.7Ω | D*10%/0.7Ω | D*6%/0.9 | | | | | |
| 220 | 227 | B 18%/2.0Ω C*12%/1.0Ω | C 12%/1.2Ω D*8%/0.7Ω | C 14%/1.2Ω D*12%/0.8Ω | D 12%/1.0Ω E*8%/0.9Ω | | | | | | |
| 330 | 337 | C 16%/1.2Ω | C 14%/1.2Ω D*14%/0.7Ω | D 14%/1.0Ω | | | | | | | |
| 470 | 477 | C 18%/1.2Ω D*14%/0.7Ω | D 16%/1.0Ω | | | | | | | | |

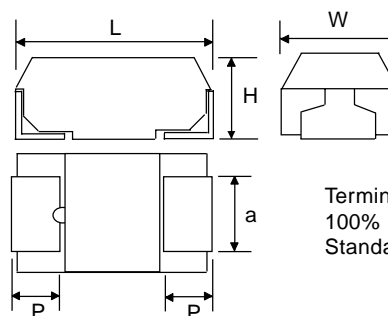
DIMENSIONS (mm)

| Case Code | Metric Code | English Code | L | W | H | P | a |
|-----------|-------------|--------------|-----------|------------|-----------|------------|-----------|
| J | 1608 | 0603 | 1.6 ± 0.1 | 0.8 ± 0.1 | 0.8 ± 0.1 | 0.3 ± 0.15 | 0.6 ± 0.1 |
| P | 2012 | 0805 | 2.0 ± 0.2 | 1.25 ± 0.2 | 1.2 MAX. | 0.5 ± 0.2 | 0.9 ± 0.1 |
| A | 3216 | 1206 | 3.2 ± 0.2 | 1.6 ± 0.2 | 1.6 ± 0.2 | 0.8 ± 0.3 | 1.2 ± 0.1 |
| A2 | 3216 | 1206 | 3.2 ± 0.2 | 1.6 ± 0.2 | 1.2 MAX. | 0.8 ± 0.3 | 1.2 ± 0.1 |
| B | 3528 | 1411 | 3.5 ± 0.2 | 2.8 ± 0.2 | 1.9 ± 0.2 | 0.8 ± 0.3 | 2.2 ± 0.1 |
| B2 | 3528 | 1411 | 3.5 ± 0.2 | 2.8 ± 0.2 | 1.2 MAX. | 0.8 ± 0.3 | 2.3 ± 0.1 |
| C | 6032 | 2412 | 6.0 ± 0.3 | 3.2 ± 0.3 | 2.6 ± 0.3 | 1.3 ± 0.3 | 2.2 ± 0.1 |
| D | 7343 | 2916 | 7.3 ± 0.2 | 4.3 ± 0.2 | 2.9 ± 0.3 | 1.3 ± 0.3 | 2.4 ± 0.1 |
| E | 7343H | 2917 | 7.3 ± 0.2 | 4.3 ± 0.2 | 4.1 ± 0.2 | 1.3 ± 0.3 | 2.4 ± 0.1 |

J, P, A, A2, C, D & E CASE SIZE



B & B2 CASE SIZE



Terminations:
 100% Sn (Lead-Free)
 Standard

CAPACITANCE CODES

| Cap. (μF) | STD EIA Code | EIA Code 198D | Code for P Case Size | Code for J Case Size | | |
|-----------|--------------|---------------|----------------------|----------------------|------|--------|
| | | | | 2.5Vdc | 4Vdc | 6.3Vdc |
| 0.1 | 104 | A5 | - | - | - | - |
| 0.15 | 154 | E5 | - | - | - | - |
| 0.22 | 224 | J5 | - | - | - | - |
| 0.33 | 334 | N5 | N | - | - | - |
| 0.47 | 474 | S5 | S | - | - | - |
| 0.68 | 684 | W5 | W | - | - | - |
| 1.0 | 105 | A6 | A | - | - | - |
| 1.5 | 155 | E6 | E | - | - | - |
| 2.2 | 225 | J6 | J | - | - | r |
| 3.3 | 335 | N6 | N | - | - | → |
| 4.7 | 475 | S6 | S | - | ⊖ | J |
| 6.8 | 685 | W6 | W | - | G | - |
| 10 | 106 | A7 | a | e | ⊖ | - |
| 22 | 226 | J7 | - | - | - | - |

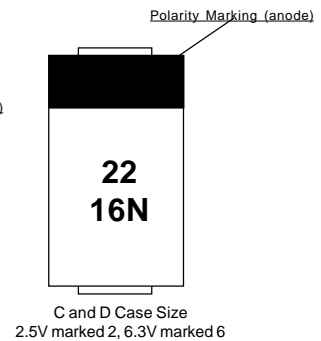
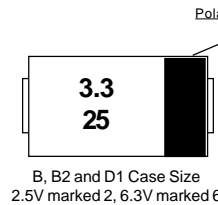
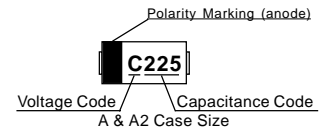
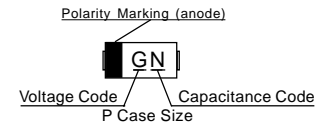
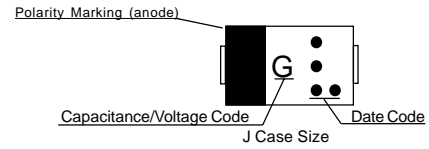
VOLTAGE CODES

| Volts | Code |
|-------|------|
| 2.5 | e |
| 4 | G |
| 6.3 | J |
| 10 | A |
| 16 | C |
| 20 | D |
| 25 | E |
| 35 | V |
| 50 | H |

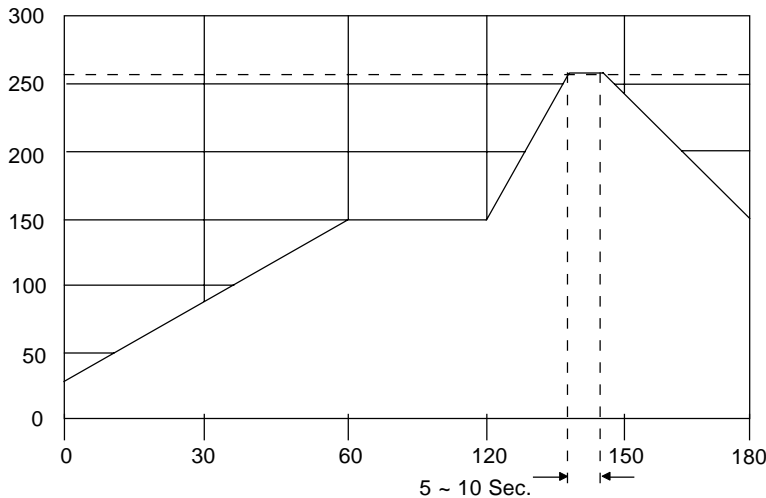
PRODUCTION CODE

| 2000 | | | | | | | | | | | |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| • | •• | • | •• | •• | •• | •• | •• | • | • | •• | •• |
| 2001 | | | | | | | | | | | |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| •• | •• | •• | •• | •• | •• | •• | •• | •• | •• | •• | •• |

COMPONENT MARKING

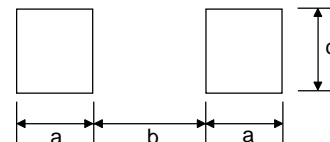


Flow/Reflow Soldering
Maximum Temperature/Time: Flow 260°C/5 Sec.
Reflow 260°C/10 Sec.



RECOMMENDED LAND PATTERN DIMENSIONS (mm)

| Case Size | a | b | c |
|-----------|------|------|------|
| J | 0.90 | 0.70 | 1.00 |
| P | 1.05 | 0.50 | 1.20 |
| A & A2 | 1.35 | 1.10 | 1.50 |
| B & B2 | 1.35 | 1.40 | 2.70 |
| C | 2.00 | 2.90 | 2.70 |
| D1 | 2.00 | 2.70 | 2.90 |
| D | 2.05 | 4.10 | 2.90 |

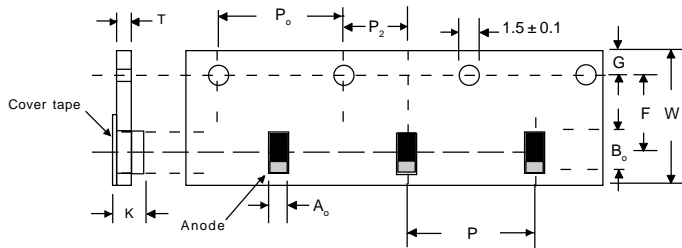


SURFACE MOUNT

TAPE DIMENSIONS (mm)

| Metric Code | Case Code | $A_0 \pm 0.2$ | $B_0 \pm 0.2$ | $W \pm .30$ | $F \pm .05$ | $P_0 \pm 0.1$ | $P_1 \pm 0.1$ | $P_2 \pm 0.05$ | $G \pm 0.1$ | $K \pm 0.2$ | T | 7" Reel |
|-------------|-----------|---------------|---------------|-------------|-------------|---------------|---------------|----------------|-------------|-------------|-----|---------|
| 1608 | J | 1.0 | 1.8 | 8.0 | 3.5 | 4.0 | 4.0 | 2.0 | 1.75 | 1.1 | 0.2 | 4000 |
| 2012 | P | 1.4 | 2.2 | 8.0 | 3.5 | 4.0 | 4.0 | 2.0 | 1.75 | 1.4 | 0.2 | 3000 |
| 3216 | A2 | 1.9 | 3.5 | 8.0 | 3.5 | 4.0 | 4.0 | 2.0 | 1.75 | 1.4 | 0.2 | 3000 |
| 3216 | A | 1.9 | 3.5 | 8.0 | 3.5 | 4.0 | 4.0 | 2.0 | 1.75 | 1.9 | 0.2 | 2000 |
| 3528 | B2 | 3.2 | 3.8 | 8.0 | 3.5 | 4.0 | 4.0 | 2.0 | 1.75 | 1.4 | 0.2 | 3000 |
| 3528 | B | 3.2 | 3.8 | 8.0 | 3.5 | 4.0 | 4.0 | 2.0 | 1.75 | 2.1 | 0.2 | 2000 |
| 6032 | C | 3.7 | 6.4 | 12.0 | 5.65 | 4.0 | 8.0 | 2.0 | 1.5 | 3.0 | 0.3 | 500 |
| 7343 | D | 4.8 | 7.7 | 12.0 | 5.65 | 4.0 | 8.0 | 2.0 | 1.5 | 3.3 | 0.3 | 500 |
| 7343H | E | 4.7 | 7.7 | 12.0 | 5.5 | 4.0 | 8.0 | 2.0 | 1.5 | 4.5 | 0.6 | 500 |

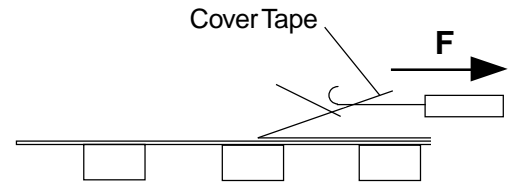
SURFACE MOUNT



Cover tape peel-off specification

1. Peel-off speed : 300 mm/min.
2. Peel-off force : $F = 30 - 75g$
3. Peel-off angle : $\Theta = 0 - 15^\circ$

Peel-off speed
(F) = 50mm/Sec.



REEL DIMENSIONS (mm)

| Tape Width | A | C | D | E | N | W1 | W2 |
|------------|---------------|--------------|--------------|---------------|---------|----------------|----------|
| 8mm | 178 ± 2.0 | 13 ± 0.5 | 21 ± 0.5 | 2.0 ± 0.5 | 50 min. | 10 ± 2.0 | 14.5 max |
| 12mm | 178 ± 2.0 | 13 ± 0.5 | 21 ± 0.5 | 2.0 ± 0.5 | 50 min. | 14.5 ± 2.0 | 18.5 max |

