

**/ Descriptions**

TO-220      N      MOS      N-CHANNEL MOSFET in a TO-220 Plastic Package.

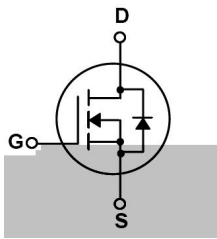
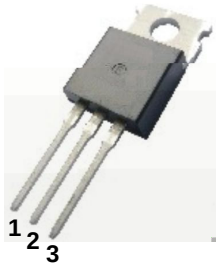
**/ Features**

Low gate charge, Low Crss , Fast switching.

**/ Applications**

PFC

These devices are well suited for high efficient switched mode power supplies, active power factor correction, electronic lamp ballast based on half bridge topology.

**/ Equivalent Circuit****/ Pinning**

PIN1   G

PIN 2   D

PIN 3   S

**/ h<sub>FE</sub> Classifications & Marking**

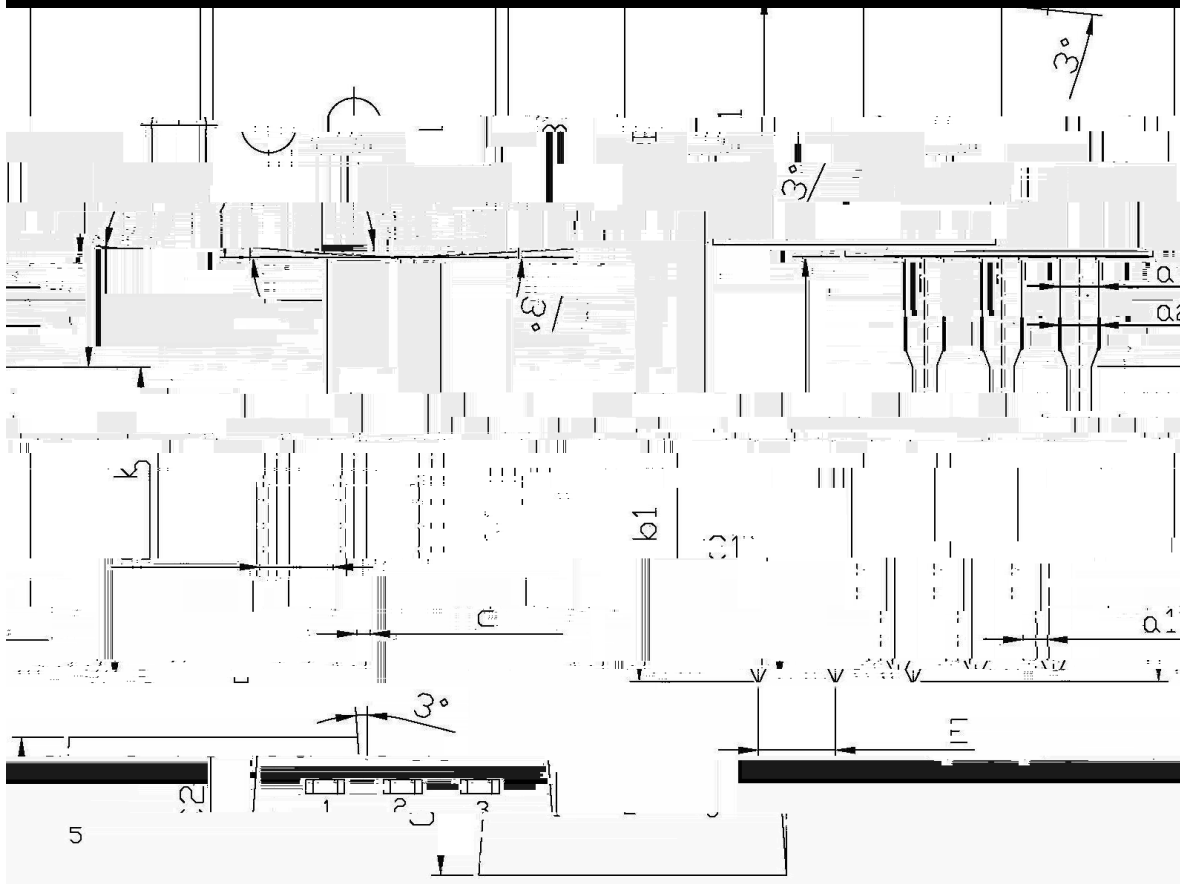
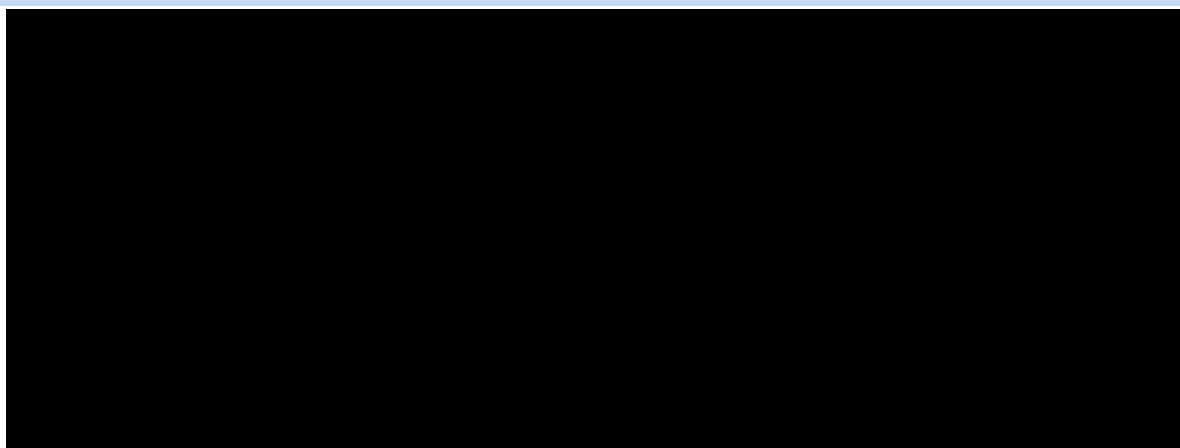
See Marking Instructions.

**BR12N60**  
Rev.F Jul.-2018



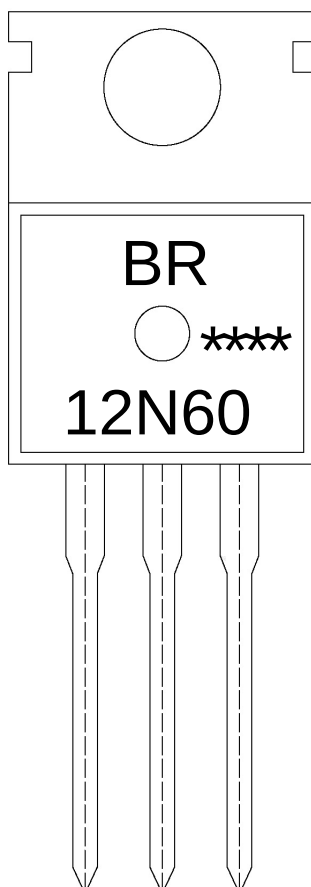


## / Package Dimensions



| Tens |      | Symbol   |       | Dimensions in Millimeters |       | Symbol |      | Dimensions in Millimeters |      |
|------|------|----------|-------|---------------------------|-------|--------|------|---------------------------|------|
| Max  | 1.4  | $\Delta$ | 9.8   | Max                       | 10.2  | C      | 1.2  | Max                       | 1.2  |
| 1.6  | 9.4  | $\Delta$ | 10.5  | 10.4                      | 3.84  | C      | 1.3  | 1.6                       | 3.1  |
| 2.2  | 2.6  | $\Delta$ | 12.6  | 15.7                      | 13.6  | C      | 1.4  | 2.2                       | 10.1 |
| 2.5  | 0.7  | $\Delta$ | 13.9  | 16.3                      | 9.6   | C      | 1.6  | 2.5                       | 10.6 |
| 3.2  | 1.3  | $\Delta$ | 14.4  | 17.8                      | 10.2  | C      | 1.8  | 3.2                       | 11.2 |
| 3.6  | 2.4  | $\Delta$ | 15.4  | 18.8                      | 11.2  | C      | 2.0  | 3.6                       | 11.8 |
| 4.0  | 2.7  | $\Delta$ | 16.4  | 19.8                      | 12.2  | C      | 2.2  | 4.0                       | 12.4 |
| 4.5  | 3.4  | $\Delta$ | 17.4  | 20.8                      | 13.2  | C      | 2.4  | 4.5                       | 13.0 |
| 5.0  | 4.0  | $\Delta$ | 18.4  | 21.8                      | 14.2  | C      | 2.6  | 5.0                       | 13.6 |
| 5.6  | 4.7  | $\Delta$ | 19.4  | 22.8                      | 15.2  | C      | 2.8  | 5.6                       | 14.2 |
| 6.3  | 5.4  | $\Delta$ | 20.4  | 23.8                      | 16.2  | C      | 3.0  | 6.3                       | 14.8 |
| 7.0  | 6.1  | $\Delta$ | 21.4  | 24.8                      | 17.2  | C      | 3.2  | 7.0                       | 15.4 |
| 7.9  | 6.8  | $\Delta$ | 22.4  | 25.8                      | 18.2  | C      | 3.4  | 7.9                       | 16.0 |
| 8.8  | 7.5  | $\Delta$ | 23.4  | 26.8                      | 19.2  | C      | 3.6  | 8.8                       | 16.6 |
| 9.8  | 8.2  | $\Delta$ | 24.4  | 27.8                      | 20.2  | C      | 3.8  | 9.8                       | 17.2 |
| 1.0  | 9.0  | $\Delta$ | 25.4  | 28.8                      | 21.2  | C      | 4.0  | 1.0                       | 17.8 |
| 1.1  | 9.8  | $\Delta$ | 26.4  | 29.8                      | 22.2  | C      | 4.2  | 1.1                       | 18.4 |
| 1.2  | 1.0  | $\Delta$ | 27.4  | 30.8                      | 23.2  | C      | 4.4  | 1.2                       | 19.0 |
| 1.3  | 1.1  | $\Delta$ | 28.4  | 31.8                      | 24.2  | C      | 4.6  | 1.3                       | 19.6 |
| 1.4  | 1.2  | $\Delta$ | 29.4  | 32.8                      | 25.2  | C      | 4.8  | 1.4                       | 20.2 |
| 1.5  | 1.3  | $\Delta$ | 30.4  | 33.8                      | 26.2  | C      | 5.0  | 1.5                       | 20.8 |
| 1.6  | 1.4  | $\Delta$ | 31.4  | 34.8                      | 27.2  | C      | 5.2  | 1.6                       | 21.4 |
| 1.7  | 1.5  | $\Delta$ | 32.4  | 35.8                      | 28.2  | C      | 5.4  | 1.7                       | 22.0 |
| 1.8  | 1.6  | $\Delta$ | 33.4  | 36.8                      | 29.2  | C      | 5.6  | 1.8                       | 22.6 |
| 1.9  | 1.7  | $\Delta$ | 34.4  | 37.8                      | 30.2  | C      | 5.8  | 1.9                       | 23.2 |
| 2.0  | 1.8  | $\Delta$ | 35.4  | 38.8                      | 31.2  | C      | 6.0  | 2.0                       | 23.8 |
| 2.1  | 1.9  | $\Delta$ | 36.4  | 39.8                      | 32.2  | C      | 6.2  | 2.1                       | 24.4 |
| 2.2  | 2.0  | $\Delta$ | 37.4  | 40.8                      | 33.2  | C      | 6.4  | 2.2                       | 25.0 |
| 2.3  | 2.1  | $\Delta$ | 38.4  | 41.8                      | 34.2  | C      | 6.6  | 2.3                       | 25.6 |
| 2.4  | 2.2  | $\Delta$ | 39.4  | 42.8                      | 35.2  | C      | 6.8  | 2.4                       | 26.2 |
| 2.5  | 2.3  | $\Delta$ | 40.4  | 43.8                      | 36.2  | C      | 7.0  | 2.5                       | 26.8 |
| 2.6  | 2.4  | $\Delta$ | 41.4  | 44.8                      | 37.2  | C      | 7.2  | 2.6                       | 27.4 |
| 2.7  | 2.5  | $\Delta$ | 42.4  | 45.8                      | 38.2  | C      | 7.4  | 2.7                       | 28.0 |
| 2.8  | 2.6  | $\Delta$ | 43.4  | 46.8                      | 39.2  | C      | 7.6  | 2.8                       | 28.6 |
| 2.9  | 2.7  | $\Delta$ | 44.4  | 47.8                      | 40.2  | C      | 7.8  | 2.9                       | 29.2 |
| 3.0  | 2.8  | $\Delta$ | 45.4  | 48.8                      | 41.2  | C      | 8.0  | 3.0                       | 29.8 |
| 3.1  | 2.9  | $\Delta$ | 46.4  | 49.8                      | 42.2  | C      | 8.2  | 3.1                       | 30.4 |
| 3.2  | 3.0  | $\Delta$ | 47.4  | 50.8                      | 43.2  | C      | 8.4  | 3.2                       | 31.0 |
| 3.3  | 3.1  | $\Delta$ | 48.4  | 51.8                      | 44.2  | C      | 8.6  | 3.3                       | 31.6 |
| 3.4  | 3.2  | $\Delta$ | 49.4  | 52.8                      | 45.2  | C      | 8.8  | 3.4                       | 32.2 |
| 3.5  | 3.3  | $\Delta$ | 50.4  | 53.8                      | 46.2  | C      | 9.0  | 3.5                       | 32.8 |
| 3.6  | 3.4  | $\Delta$ | 51.4  | 54.8                      | 47.2  | C      | 9.2  | 3.6                       | 33.4 |
| 3.7  | 3.5  | $\Delta$ | 52.4  | 55.8                      | 48.2  | C      | 9.4  | 3.7                       | 34.0 |
| 3.8  | 3.6  | $\Delta$ | 53.4  | 56.8                      | 49.2  | C      | 9.6  | 3.8                       | 34.6 |
| 3.9  | 3.7  | $\Delta$ | 54.4  | 57.8                      | 50.2  | C      | 9.8  | 3.9                       | 35.2 |
| 4.0  | 3.8  | $\Delta$ | 55.4  | 58.8                      | 51.2  | C      | 10.0 | 4.0                       | 35.8 |
| 4.1  | 3.9  | $\Delta$ | 56.4  | 59.8                      | 52.2  | C      | 10.2 | 4.1                       | 36.4 |
| 4.2  | 4.0  | $\Delta$ | 57.4  | 60.8                      | 53.2  | C      | 10.4 | 4.2                       | 37.0 |
| 4.3  | 4.1  | $\Delta$ | 58.4  | 61.8                      | 54.2  | C      | 10.6 | 4.3                       | 37.6 |
| 4.4  | 4.2  | $\Delta$ | 59.4  | 62.8                      | 55.2  | C      | 10.8 | 4.4                       | 38.2 |
| 4.5  | 4.3  | $\Delta$ | 60.4  | 63.8                      | 56.2  | C      | 11.0 | 4.5                       | 38.8 |
| 4.6  | 4.4  | $\Delta$ | 61.4  | 64.8                      | 57.2  | C      | 11.2 | 4.6                       | 39.4 |
| 4.7  | 4.5  | $\Delta$ | 62.4  | 65.8                      | 58.2  | C      | 11.4 | 4.7                       | 40.0 |
| 4.8  | 4.6  | $\Delta$ | 63.4  | 66.8                      | 59.2  | C      | 11.6 | 4.8                       | 40.6 |
| 4.9  | 4.7  | $\Delta$ | 64.4  | 67.8                      | 60.2  | C      | 11.8 | 4.9                       | 41.2 |
| 5.0  | 4.8  | $\Delta$ | 65.4  | 68.8                      | 61.2  | C      | 12.0 | 5.0                       | 41.8 |
| 5.1  | 4.9  | $\Delta$ | 66.4  | 69.8                      | 62.2  | C      | 12.2 | 5.1                       | 42.4 |
| 5.2  | 5.0  | $\Delta$ | 67.4  | 70.8                      | 63.2  | C      | 12.4 | 5.2                       | 43.0 |
| 5.3  | 5.1  | $\Delta$ | 68.4  | 71.8                      | 64.2  | C      | 12.6 | 5.3                       | 43.6 |
| 5.4  | 5.2  | $\Delta$ | 69.4  | 72.8                      | 65.2  | C      | 12.8 | 5.4                       | 44.2 |
| 5.5  | 5.3  | $\Delta$ | 70.4  | 73.8                      | 66.2  | C      | 13.0 | 5.5                       | 44.8 |
| 5.6  | 5.4  | $\Delta$ | 71.4  | 74.8                      | 67.2  | C      | 13.2 | 5.6                       | 45.4 |
| 5.7  | 5.5  | $\Delta$ | 72.4  | 75.8                      | 68.2  | C      | 13.4 | 5.7                       | 46.0 |
| 5.8  | 5.6  | $\Delta$ | 73.4  | 76.8                      | 69.2  | C      | 13.6 | 5.8                       | 46.6 |
| 5.9  | 5.7  | $\Delta$ | 74.4  | 77.8                      | 70.2  | C      | 13.8 | 5.9                       | 47.2 |
| 6.0  | 5.8  | $\Delta$ | 75.4  | 78.8                      | 71.2  | C      | 14.0 | 6.0                       | 47.8 |
| 6.1  | 5.9  | $\Delta$ | 76.4  | 79.8                      | 72.2  | C      | 14.2 | 6.1                       | 48.4 |
| 6.2  | 6.0  | $\Delta$ | 77.4  | 80.8                      | 73.2  | C      | 14.4 | 6.2                       | 49.0 |
| 6.3  | 6.1  | $\Delta$ | 78.4  | 81.8                      | 74.2  | C      | 14.6 | 6.3                       | 49.6 |
| 6.4  | 6.2  | $\Delta$ | 79.4  | 82.8                      | 75.2  | C      | 14.8 | 6.4                       | 50.2 |
| 6.5  | 6.3  | $\Delta$ | 80.4  | 83.8                      | 76.2  | C      | 15.0 | 6.5                       | 50.8 |
| 6.6  | 6.4  | $\Delta$ | 81.4  | 84.8                      | 77.2  | C      | 15.2 | 6.6                       | 51.4 |
| 6.7  | 6.5  | $\Delta$ | 82.4  | 85.8                      | 78.2  | C      | 15.4 | 6.7                       | 52.0 |
| 6.8  | 6.6  | $\Delta$ | 83.4  | 86.8                      | 79.2  | C      | 15.6 | 6.8                       | 52.6 |
| 6.9  | 6.7  | $\Delta$ | 84.4  | 87.8                      | 80.2  | C      | 15.8 | 6.9                       | 53.2 |
| 7.0  | 6.8  | $\Delta$ | 85.4  | 88.8                      | 81.2  | C      | 16.0 | 7.0                       | 53.8 |
| 7.1  | 6.9  | $\Delta$ | 86.4  | 89.8                      | 82.2  | C      | 16.2 | 7.1                       | 54.4 |
| 7.2  | 7.0  | $\Delta$ | 87.4  | 90.8                      | 83.2  | C      | 16.4 | 7.2                       | 55.0 |
| 7.3  | 7.1  | $\Delta$ | 88.4  | 91.8                      | 84.2  | C      | 16.6 | 7.3                       | 55.6 |
| 7.4  | 7.2  | $\Delta$ | 89.4  | 92.8                      | 85.2  | C      | 16.8 | 7.4                       | 56.2 |
| 7.5  | 7.3  | $\Delta$ | 90.4  | 93.8                      | 86.2  | C      | 17.0 | 7.5                       | 56.8 |
| 7.6  | 7.4  | $\Delta$ | 91.4  | 94.8                      | 87.2  | C      | 17.2 | 7.6                       | 57.4 |
| 7.7  | 7.5  | $\Delta$ | 92.4  | 95.8                      | 88.2  | C      | 17.4 | 7.7                       | 58.0 |
| 7.8  | 7.6  | $\Delta$ | 93.4  | 96.8                      | 89.2  | C      | 17.6 | 7.8                       | 58.6 |
| 7.9  | 7.7  | $\Delta$ | 94.4  | 97.8                      | 90.2  | C      | 17.8 | 7.9                       | 59.2 |
| 8.0  | 7.8  | $\Delta$ | 95.4  | 98.8                      | 91.2  | C      | 18.0 | 8.0                       | 59.8 |
| 8.1  | 7.9  | $\Delta$ | 96.4  | 99.8                      | 92.2  | C      | 18.2 | 8.1                       | 60.4 |
| 8.2  | 8.0  | $\Delta$ | 97.4  | 100.8                     | 93.2  | C      | 18.4 | 8.2                       | 61.0 |
| 8.3  | 8.1  | $\Delta$ | 98.4  | 101.8                     | 94.2  | C      | 18.6 | 8.3                       | 61.6 |
| 8.4  | 8.2  | $\Delta$ | 99.4  | 102.8                     | 95.2  | C      | 18.8 | 8.4                       | 62.2 |
| 8.5  | 8.3  | $\Delta$ | 100.4 | 103.8                     | 96.2  | C      | 19.0 | 8.5                       | 62.8 |
| 8.6  | 8.4  | $\Delta$ | 101.4 | 104.8                     | 97.2  | C      | 19.2 | 8.6                       | 63.4 |
| 8.7  | 8.5  | $\Delta$ | 102.4 | 105.8                     | 98.2  | C      | 19.4 | 8.7                       | 64.0 |
| 8.8  | 8.6  | $\Delta$ | 103.4 | 106.8                     | 99.2  | C      | 19.6 | 8.8                       | 64.6 |
| 8.9  | 8.7  | $\Delta$ | 104.4 | 107.8                     | 100.2 | C      | 19.8 | 8.9                       | 65.2 |
| 9.0  | 8.8  | $\Delta$ | 105.4 | 108.8                     | 101.2 | C      | 20.0 | 9.0                       | 65.8 |
| 9.1  | 8.9  | $\Delta$ | 106.4 | 109.8                     | 102.2 | C      | 20.2 | 9.1                       | 66.4 |
| 9.2  | 9.0  | $\Delta$ | 107.4 | 110.8                     | 103.2 | C      | 20.4 | 9.2                       | 67.0 |
| 9.3  | 9.1  | $\Delta$ | 108.4 | 111.8                     | 104.2 | C      | 20.6 | 9.3                       | 67.6 |
| 9.4  | 9.2  | $\Delta$ | 109.4 | 112.8                     | 105.2 | C      | 20.8 | 9.4                       | 68.2 |
| 9.5  | 9.3  | $\Delta$ | 110.4 | 113.8                     | 106.2 | C      | 21.0 | 9.5                       | 68.8 |
| 9.6  | 9.4  | $\Delta$ | 111.4 | 114.8                     | 107.2 | C      | 21.2 | 9.6                       | 69.4 |
| 9.7  | 9.5  | $\Delta$ | 112.4 | 115.8                     | 108.2 | C      | 21.4 | 9.7                       | 70.0 |
| 9.8  | 9.6  | $\Delta$ | 113.4 | 116.8                     | 109.2 | C      | 21.6 | 9.8                       | 70.6 |
| 9.9  | 9.7  | $\Delta$ | 114.4 | 117.8                     | 110.2 | C      | 21.8 | 9.9                       | 71.2 |
| 10.0 | 9.8  | $\Delta$ | 115.4 | 118.8                     | 111.2 | C      | 22.0 | 10.0                      | 71.8 |
| 10.1 | 9.9  | $\Delta$ | 116.4 | 119.8                     | 112.2 | C      | 22.2 | 10.1                      | 72.4 |
| 10.2 | 10.0 | $\Delta$ | 117.4 | 120.8                     | 113.2 | C      | 22.4 | 10.2                      | 73.0 |
| 10.3 | 10.1 | $\Delta$ | 118.4 | 121.8                     | 114.2 | C      | 22.6 | 10.3                      | 73.6 |
| 10.4 | 10.2 | $\Delta$ | 119.4 | 122.8                     | 115.2 | C      | 22.8 | 10.4                      | 74.2 |
| 10.5 | 10.3 | $\Delta$ | 120.4 | 123.8                     | 116.2 | C      | 23.0 | 10.5                      | 74.8 |
| 10.6 | 10.4 | $\Delta$ | 121.4 | 124.8                     | 117.2 | C      | 23.2 | 10.6                      | 75.4 |
| 10.7 | 10.5 | $\Delta$ | 122.4 | 125.8                     | 118.2 | C      | 23.4 | 10.7                      | 76.0 |
| 10.8 | 10.6 | $\Delta$ | 123.4 | 126.8                     | 119.2 | C      | 23.6 | 10.8                      | 76.6 |
| 10.9 | 10.7 | $\Delta$ | 124.4 | 127.8                     | 120.2 | C      | 23.8 | 10.9                      | 77.2 |
| 11.0 | 10.8 | $\Delta$ | 125.4 | 128.8                     | 121.2 | C      | 24.0 | 11.0                      | 77.8 |
| 11.1 | 10.9 | $\Delta$ | 126.4 | 129.8                     | 122.2 | C      | 24.2 | 11.1                      | 78.4 |
| 11.2 | 11.0 | $\Delta$ | 127.4 | 130.8                     | 123.2 | C      | 24.4 | 11.2                      | 79.0 |
| 11.3 | 11.1 | $\Delta$ | 128.4 | 131.8                     | 124.2 | C      | 24.6 | 11.3                      | 79.6 |
| 11.4 | 11.2 | $\Delta$ | 129.4 | 132.8                     | 125.2 | C      | 24.8 | 11.4                      | 80.2 |
| 11.5 | 11.3 | $\Delta$ | 130.4 | 133.8                     | 126.2 | C      | 25.0 | 11.5                      | 80.8 |
| 11.6 | 11.4 | $\Delta$ | 131.4 | 134.8                     | 127.2 | C      | 25.2 | 11.6                      | 81.4 |
| 11.7 | 11.5 | $\Delta$ | 132.4 | 135.8                     | 128.2 | C      | 25.4 | 11.7                      | 82.0 |
| 11.8 | 11.6 | $\Delta$ | 133.4 | 136.8                     | 129.2 | C      | 25.6 | 11.8                      | 82.6 |
| 11.9 | 11.7 | $\Delta$ | 134.4 | 137.8                     | 130.2 | C      | 25.8 | 11.9                      | 83.2 |
| 12.0 | 11.8 | $\Delta$ | 135.4 | 138.8                     | 131.2 | C      | 26.0 | 12.0                      | 83.8 |
| 12.1 | 11.9 | $\Delta$ | 136.4 | 139.8                     | 132.2 | C      | 26.2 | 12.1                      | 84.4 |
| 12.2 | 12.0 | $\Delta$ | 137.4 | 140.8                     | 133.2 | C      | 26.4 | 12.2                      | 85.0 |
| 12.3 | 12.1 | $\Delta$ | 138.4 | 141.8                     | 134.2 | C      | 26.6 | 12.3                      | 85.6 |
| 12.4 | 12.2 | $\Delta$ | 139.4 | 142.8                     | 135.2 | C      | 26.8 | 12.4                      | 86.2 |
| 12.5 | 12.3 | $\Delta$ | 140.4 | 143.8                     | 136.2 | C      | 27.0 | 12.5                      | 86.8 |
| 12.6 | 12.4 | $\Delta$ | 141.4 | 144.8                     | 137.2 | C      | 27.2 | 12.6                      | 87.4 |
| 12.7 | 12.5 | $\Delta$ | 142.4 | 145.8                     | 138.2 | C      | 27.4 | 12.7                      | 88.0 |
| 12.8 | 12.6 | $\Delta$ | 143.4 | 146.8                     | 139.2 | C      | 27.6 | 12.8                      | 88.6 |
| 12.9 | 12.7 | $\Delta$ | 144.4 | 147.8                     | 140.2 | C      | 27.8 | 12.9                      | 89.2 |
| 13.0 | 12.8 | $\Delta$ | 145.4 | 148.8                     | 141.2 | C      | 28.0 | 13.0                      | 89.8 |
| 13.1 | 12.9 | $\Delta$ | 146.4 | 149.8                     | 142.2 | C      | 28.2 | 13.1                      | 90.4 |
| 13.2 | 13.0 | $\Delta$ | 147.4 | 150.8                     | 143.2 | C      | 28.4 | 13.2                      | 91.0 |

/ Marking Instructions



BR

12N60

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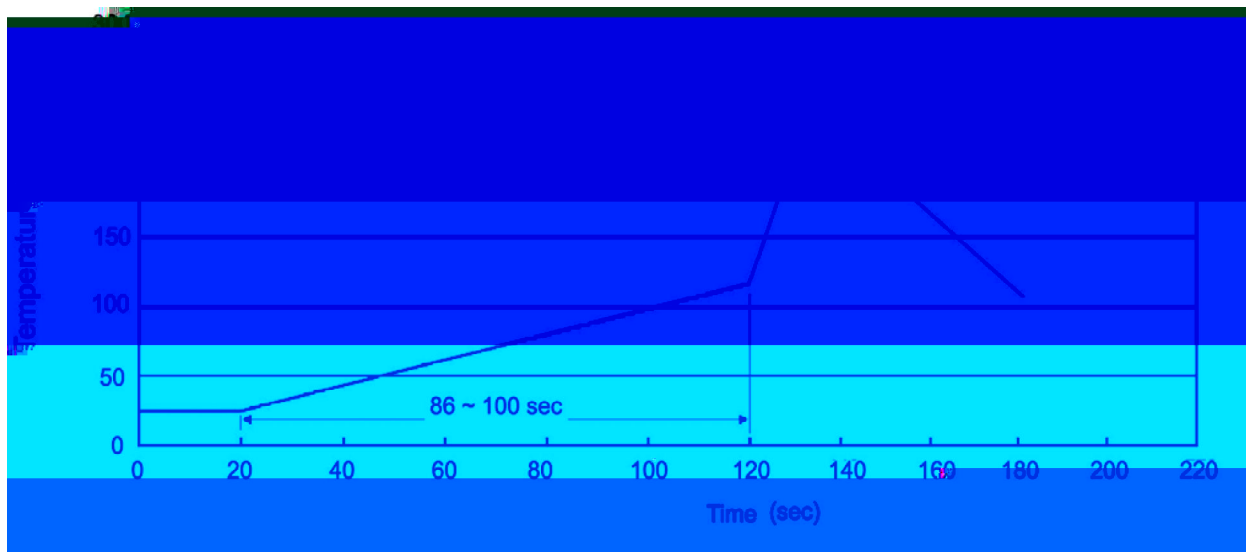
Note:

BR: Company Code

12N60: Product Type.

\*\*\*\*: Lot No. Code, code change with Lot No.

( ) / Temperature Profile for Dip Soldering(Pb-Free)



Note:

- |   |       |     |           |        |                                         |
|---|-------|-----|-----------|--------|-----------------------------------------|
| 1 | 25    | 150 | 60        | 90sec; | 1.Preheating:25~150 , Time:60~90sec.    |
| 2 | 255±5 |     | 5±0.5sec; |        | 2.Peak Temp.:255±5 , Duration:5±0.5sec. |
| 3 |       | 2   | 10        | /sec.  | 3. Cooling Speed: 2~10 /sec.            |

/ Resistance to Soldering Heat Test Conditions

270±5      10±1 sec.      Temp.:270±5      Time:10±1 sec

/ Packaging SPEC.

/ BULK

| Package Type<br>封装形式 | Units 包装数量       |                       |                        |                              |                        | Dimension 包装尺寸 (unit: mm <sup>3</sup> ) |             |             |
|----------------------|------------------|-----------------------|------------------------|------------------------------|------------------------|-----------------------------------------|-------------|-------------|
|                      | Units/Bag<br>只/袋 | Bags/Inner Box<br>袋/盒 | Units/Inner Box<br>只/盒 | Inner Boxes/Outer Box<br>盒/箱 | Units/Outer Box<br>只/箱 | Bag 袋                                   | Inner Box 盒 | Outer Box 箱 |
| TO-220/F             | 200              | 10                    | 2,000                  | 5                            | 10,000                 | 135×190                                 | 237×172×102 | 560×245×195 |

/ TUBE

| Package Type<br>封装形式 | Units 包装数量         |                         |                        |                              |                        | Dimension 包装尺寸 (unit: mm <sup>3</sup> ) |             |             |
|----------------------|--------------------|-------------------------|------------------------|------------------------------|------------------------|-----------------------------------------|-------------|-------------|
|                      | Units/Tube<br>只/套管 | Tubes/Inner Box<br>套管/盒 | Units/Inner Box<br>只/盒 | Inner Boxes/Outer Box<br>盒/箱 | Units/Outer Box<br>只/箱 | Tube 套管                                 | Inner Box 盒 | Outer Box 箱 |
| TO-220/F             | 50                 | 20                      | 1,000                  | 5                            | 5,000                  | 532×31.4×5.5                            | 555×164×50  | 575×290×180 |

/ Notices