



# P011xx

## Sensitive high immunity SCRs up to 0.8 A

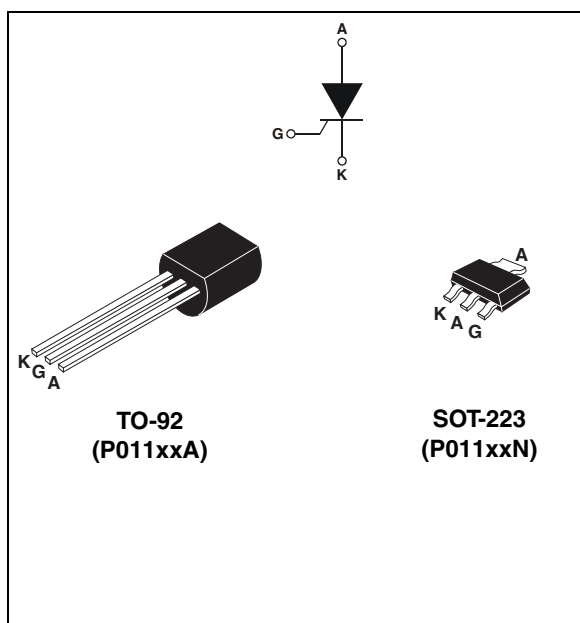
### Features

- $I_{T(RMS)}$  up to 0.8 A
- $V_{DRM}/V_{RRM}$  400 and 600 V
- $I_{GT}$  from 0.5 to 25  $\mu$ A

### Description

Thanks to highly sensitive triggering levels, the P011xx SCR series is suitable for all applications where available gate current is limited, such as ground fault circuit interruptors, pilot circuits in solid state relays, standby mode power supplies, smoke and alarm detectors.

Available in through-hole or surface-mount packages, the voltage capability of this series has been upgraded since its introduction and is now available up to 600 V.



**Table 1. Device summary**

| Order code                 | Voltage |       | Sensitivity |            | Package |
|----------------------------|---------|-------|-------------|------------|---------|
|                            | 400 V   | 600 V | Min.        | Max.       |         |
| P0111DA 1AA3               | X       |       | 4 $\mu$ A   | 25 $\mu$ A | TO-92   |
| P0111DA 5AL3               | X       |       | 4 $\mu$ A   | 25 $\mu$ A | TO-92   |
| P0111DN 5AA4               | X       |       | 4 $\mu$ A   | 25 $\mu$ A | SOT-223 |
| P0111MA 1AA3               |         | X     | 4 $\mu$ A   | 25 $\mu$ A | TO-92   |
| P0111MA2AL3 <sup>(1)</sup> |         | X     | 4 $\mu$ A   | 25 $\mu$ A | TO-92   |
| P0111MN 5AA4               |         | X     | 4 $\mu$ A   | 25 $\mu$ A | SOT-223 |
| P0115DA 1AA3               | X       |       | 15 $\mu$ A  | 50 $\mu$ A | TO-92   |
| P0115DA 5AL3               | X       |       | 15 $\mu$ A  | 50 $\mu$ A | TO-92   |
| P0118DA 1AA3               | X       |       | 0.5 $\mu$ A | 5 $\mu$ A  | TO-92   |
| P0118DA 5AL3               | X       |       | 0.5 $\mu$ A | 5 $\mu$ A  | TO-92   |
| P0118DN 5AA4               | X       |       | 0.5 $\mu$ A | 5 $\mu$ A  | SOT-223 |
| P0118MA 2AL3               |         | X     | 0.5 $\mu$ A | 5 $\mu$ A  | TO-92   |
| P0118MA 5AL3               |         | X     | 0.5 $\mu$ A | 5 $\mu$ A  | TO-92   |

1. This order code has no space.

# 1 Characteristics

**Table 2. Absolute ratings (limiting values)**

| Symbol             | Parameter   |                         | Value                    | Unit                           |             |
|--------------------|---|-------------------------|--------------------------|--------------------------------|-------------|
| $I_{T(RMS)}$       | RMS on-state current (180° conduction angle)  | TO-92                   | $T_j = 55\text{ °C}$     | 0.8                            | A           |
|                    |   | SOT-223                 | $T_{amb} = 70\text{ °C}$ |                                |             |
| $I_{T(AV)}$        | Average on-state current (180° conduction angle)  | TO-92                   | $T_j = 55\text{ °C}$     | 0.5                            | A           |
|                    |   | SOT-223                 | $T_{amb} = 70\text{ °C}$ |                                |             |
| $I_{TSM}$          | Non repetitive surge peak on-state current  | $t_p = 8.3\text{ ms}$   | $T_j = 25\text{ °C}$     | 8                              | A           |
|                    |   | $t_p = 10\text{ ms}$    |                          | 7                              |             |
| $I^2t$             | $I^2t$ Value for fusing   | $t_p = 10\text{ ms}$    | $T_j = 25\text{ °C}$     | 0.24                           | $A^2s$      |
| dI/dt              | Critical rate of rise of on-state current<br>$I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$ | F = 60 Hz               | $T_j = 125\text{ °C}$    | 50                             | A/ $\mu s$  |
| $I_{GM}$           | Peak gate current   | $t_p = 20\text{ }\mu s$ | $T_j = 125\text{ °C}$    | 1                              | A           |
| $P_{G(AV)}$        | Average gate power dissipation  |                         | $T_j = 125\text{ °C}$    | 0.1                            | W           |
| $T_{stg}$<br>$T_j$ | Storage junction temperature range<br>Operating junction temperature range                      |                         |                          | - 40 to + 150<br>- 40 to + 125 | $^{\circ}C$ |

**Table 3. Electrical characteristics ( $T_j = 25\text{ °C}$ , unless otherwise specified)**

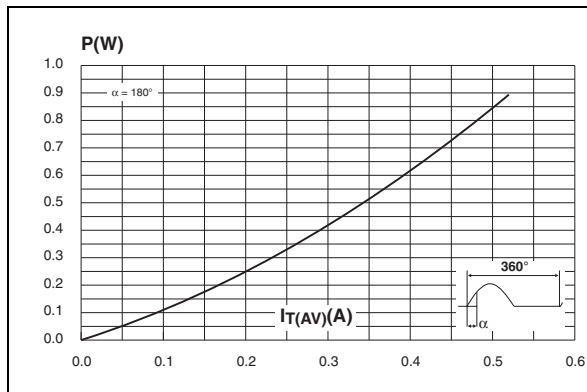
| Symbol                 | Test conditions  |      | P0111 | P0115 | P0118 | Unit       |
|------------------------|--|------|-------|-------|-------|------------|
| $I_{GT}$               | $V_D = 12\text{ V}$ $R_L = 140\text{ }\Omega$  | Min. | 4     | 15    | 0.5   | $\mu A$    |
|                        |  | Max. | 25    | 50    | 5     |            |
| $V_{GT}$               |  | Max. | 0.8   |       |       | V          |
| $V_{GD}$               | $V_D = V_{DRM}$ $R_L = 3.3\text{ k}\Omega$ $R_{GK} = 1\text{ k}\Omega$ $T_j = 125\text{ °C}$ | Min. | 0.1   |       |       | V          |
| $V_{RG}$               | $I_{RG} = 10\text{ }\mu A$   | Min. | 8     |       |       | V          |
| $I_H$                  | $I_T = 50\text{ mA}$ $R_{GK} = 1\text{ k}\Omega$   | Max. | 5     |       |       | mA         |
| $I_L$                  | $I_G = 1\text{ mA}$ $R_{GK} = 1\text{ k}\Omega$  | Max. | 6     |       |       | mA         |
| dV/dt                  | $V_D = 67\% V_{DRM}$ $R_{GK} = 1\text{ k}\Omega$ $T_j = 125\text{ °C}$                       | Min. | 80    | 75    | 75    | V/ $\mu s$ |
| $V_{TM}$               | $I_{TM} = 1.6\text{ A}$ $t_p = 380\text{ }\mu s$ $T_j = 25\text{ °C}$                        | Max. | 1.95  |       |       | V          |
| $V_{t0}$               | Threshold voltage $T_j = 125\text{ °C}$  | Max. | 0.95  |       |       | V          |
| $R_d$                  | Dynamic resistance $T_j = 125\text{ °C}$   | Max. | 600   |       |       | m $\Omega$ |
| $I_{DRM}$<br>$I_{RRM}$ | $V_{DRM} = V_{RRM} = 400\text{ V}$ $R_{GK} = 1\text{ k}\Omega$                               | Max. | 1     |       |       | $\mu A$    |
|                        | $V_{DRM} = V_{RRM} = 600\text{ V}$ $R_{GK} = 1\text{ k}\Omega$ $T_j = 25\text{ °C}$          |      | 10    |       |       |            |
|                        | $V_{DRM} = V_{RRM}$ $R_{GK} = 1\text{ k}\Omega$ $T_j = 125\text{ °C}$                        |      | 100   |       |       |            |

**Table 4. Thermal resistance**

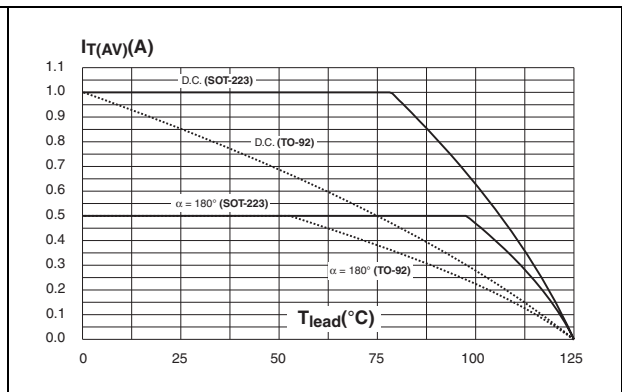
| Symbol        | Parameter                |                                    | Maximum | Unit          |
|---------------|--------------------------|------------------------------------|---------|---------------|
| $R_{th(j-a)}$ | Junction to case (DC)    | TO-92                              | 80      | $^{\circ}C/W$ |
| $R_{th(j-t)}$ | Junction to tab (DC)     | SOT-223                            | 30      | $^{\circ}C/W$ |
| $R_{th(j-a)}$ | Junction to ambient (DC) | TO-92                              | 150     | $^{\circ}C/W$ |
|               |                          | $S^{(1)} = 5 \text{ cm}^2$ SOT-223 | 60      |               |

1.  $S$  = Copper surface under tab.

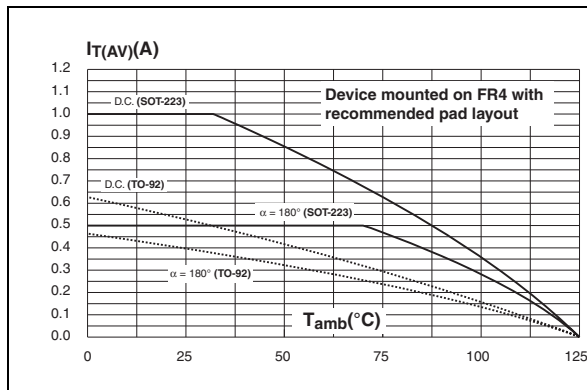
**Figure 1. Maximum average power dissipation versus average on-state current**



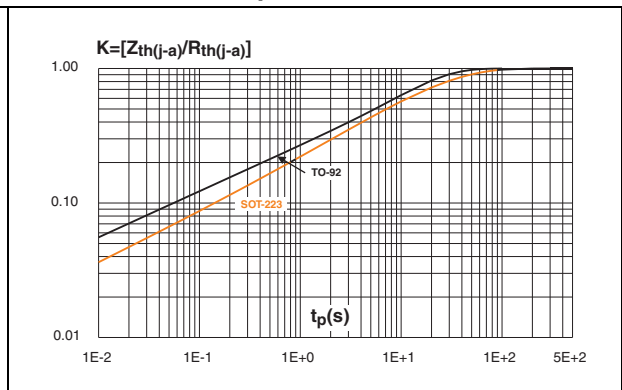
**Figure 2. Average and DC on-state current versus lead temperature**



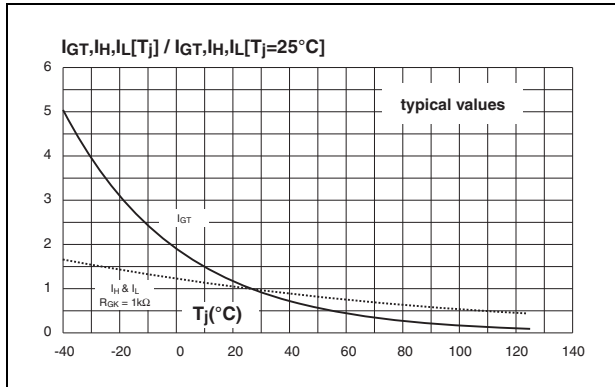
**Figure 3. Average and DC on-state current versus ambient temperature**



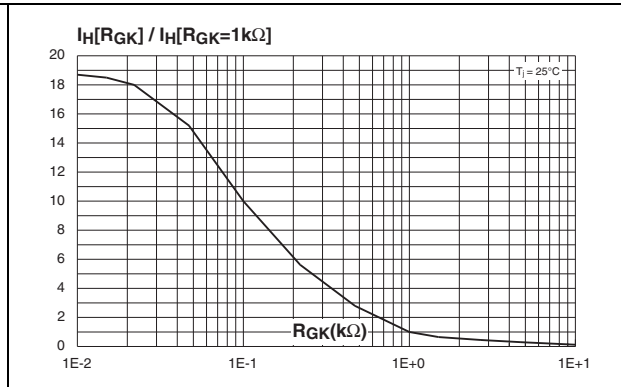
**Figure 4. Relative variation of thermal impedance junction to ambient versus pulse duration**



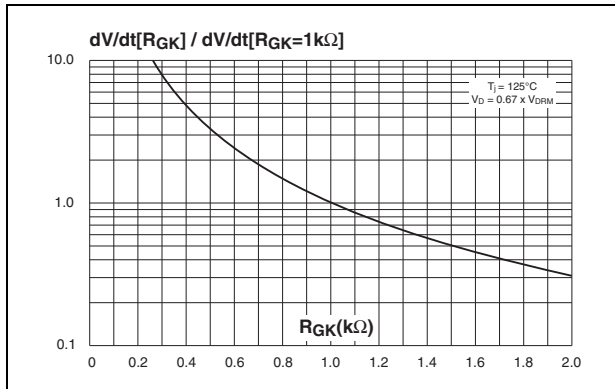
**Figure 5. Relative variation of gate trigger, holding and latching current versus junction temperature**



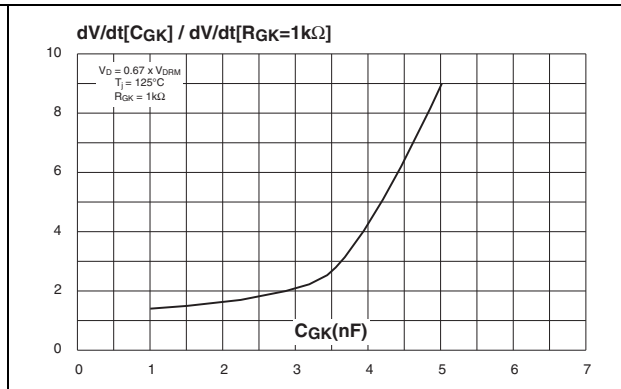
**Figure 6. Relative variation of holding current versus gate-cathode resistance (typical values)**



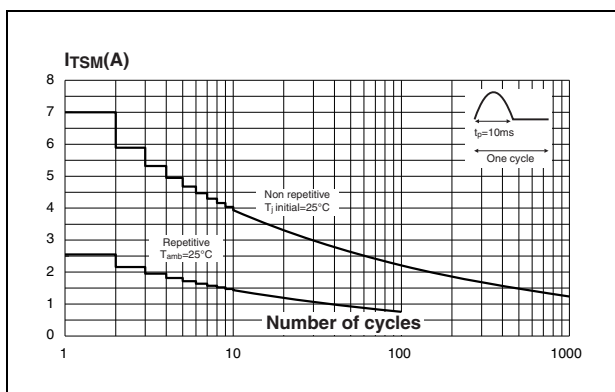
**Figure 7. Relative variation of dV/dt immunity versus gate-cathode resistance (typical values).**



**Figure 8. Relative variation of dV/dt immunity versus gate-cathode capacitance (typical values)**



**Figure 9. Surge peak on-state current versus number of cycles**



**Figure 10. Non-repetitive surge peak on-state current and corresponding value of I²t**

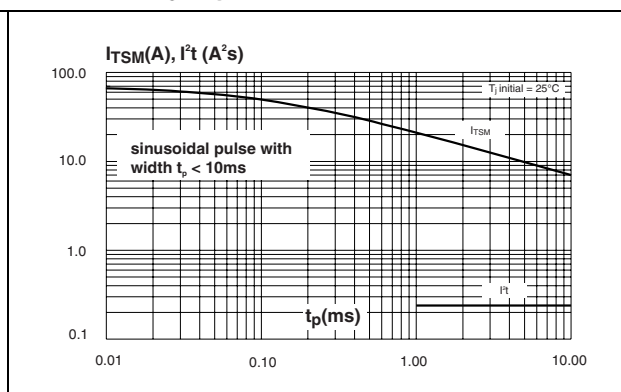


Figure 11. On-state characteristics (maximum values)

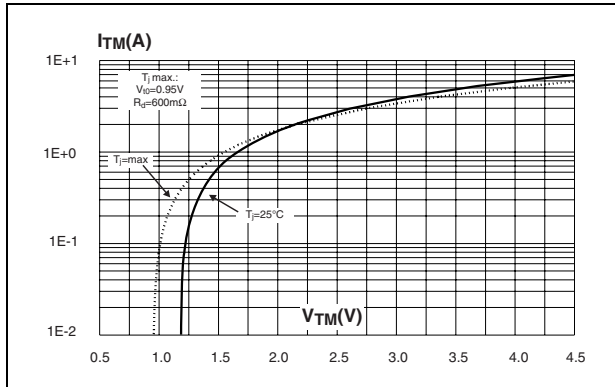
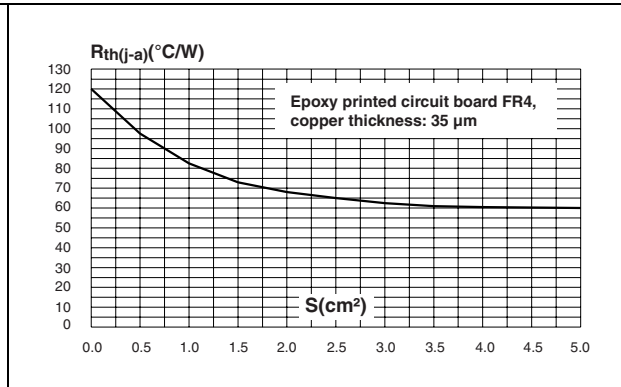
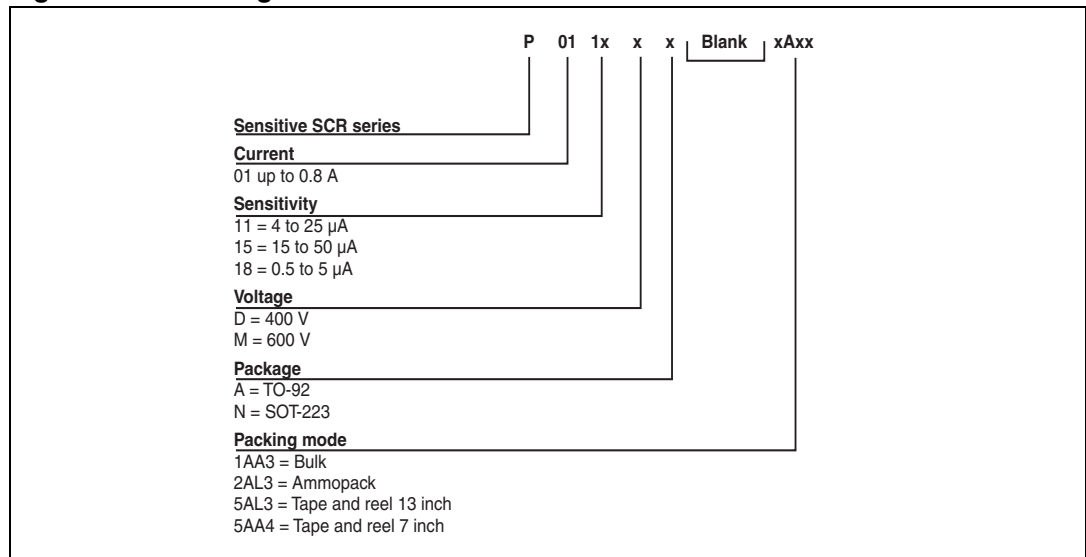


Figure 12. Thermal resistance junction to ambient versus copper surface under tab



## 2 Ordering information scheme

Figure 13. Ordering information scheme



### 3 Package information

- Epoxy meets UL94, V0

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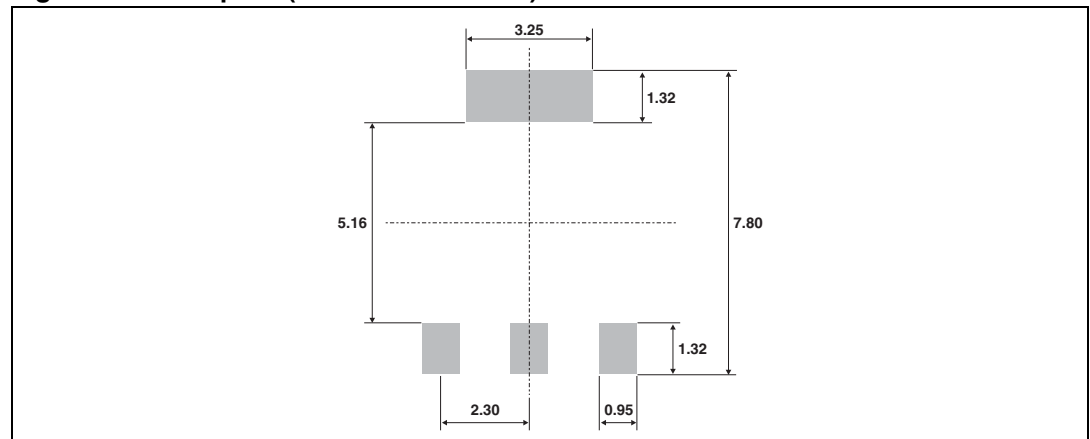
**Table 5. TO-92 dimensions**

| Ref | dimensions  |      |      |        |       |       |
|-----|-------------|------|------|--------|-------|-------|
|     | Millimeters |      |      | Inches |       |       |
|     | Min         | Typ  | Max  | Min    | Typ   | Max   |
| A   |             | 1.35 |      |        | 0.053 |       |
| B   |             |      | 4.70 |        |       | 0.185 |
| C   |             | 2.54 |      |        | 0.100 |       |
| D   | 4.40        |      |      | 0.173  |       |       |
| E   | 12.70       |      |      | 0.500  |       |       |
| F   |             |      | 3.70 |        |       | 0.146 |
| a   |             |      | 0.50 |        |       | 0.019 |

Table 6. SOT-223 dimensions

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    |             |      | 1.80 |        |       | 0.071 |
| A1   |             | 0.02 |      |        | 0.001 |       |
| B    | 0.60        | 0.70 | 0.80 | 0.024  | 0.027 | 0.031 |
| B1   | 2.90        | 3.00 | 3.10 | 0.114  | 0.118 | 0.122 |
| c    | 0.24        | 0.26 | 0.32 | 0.009  | 0.010 | 0.013 |
| D    | 6.30        | 6.50 | 6.70 | 0.248  | 0.256 | 0.264 |
| e    |             | 2.3  |      |        | 0.090 |       |
| e1   |             | 4.6  |      |        | 0.181 |       |
| E    | 3.30        | 3.50 | 3.70 | 0.130  | 0.138 | 0.146 |
| H    | 6.70        | 7.00 | 7.30 | 0.264  | 0.276 | 0.287 |
| V    | 10° max     |      |      |        |       |       |

Figure 14. Footprint (dimensions in mm)



## 4 Ordering information

**Table 7. Ordering information**

| Order code                 | Marking  | Package | Weight | Base qty | Packing mode          |
|----------------------------|----------|---------|--------|----------|-----------------------|
| P0111DA 1AA3               | P0111 DA | TO-92   | 0.2 g  | 2500     | BAG                   |
| P0111DA 5AL3               | P0111 DA | TO-92   | 0.2 g  | 2000     | Tape and reel 13 inch |
| P0111DN 5AA4               | P1D      | SOT-223 | 0.11 g | 1000     | Tape and reel 7 inch  |
| P0111MA 1AA3               | P0111 MA | TO-92   | 0.2 g  | 2500     | Bag                   |
| P0111MA2AL3 <sup>(1)</sup> | P0111 MA | TO-92   | 0.2 g  | 2000     | Ammopack              |
| P0111MN 5AA4               | P1M      | SOT-223 | 0.11 g | 1000     | Tape and reel 7 inch  |
| P0115DA 1AA3               | P0115 DA | TO-92   | 0.2 g  | 2500     | Bag                   |
| P0115DA 5AL3               | P0115 DA | TO-92   | 0.2 g  | 2000     | Tape and reel 13 inch |
| P0118DA 1AA3               | P0118 DA | TO-92   | 0.2 g  | 2500     | Bag                   |
| P0118DA 5AL3               | P0118 DA | TO-92   | 0.2 g  | 2000     | Tape and reel 13 inch |
| P0118DN 5AA4               | P8D      | SOT-223 | 0.11 g | 1000     | Tape and reel 7 inch  |
| P0118MA 2AL3               | P0118 MA | TO-92   | 0.2 g  | 2000     | Ammopack              |
| P0118MA 5AL3               | P0118 MA | TO-92   | 0.2 g  | 2000     | Tape and reel 13 inch |

1. This order code has no space.

## 5 Revision history

**Table 8. Document revision history**

| Date        | Revision | Description of changes |
|-------------|----------|------------------------|
| 26-Jan-2009 | 1        | First issue.           |



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