

## Description

The AP9101C is a protection IC developed for lithium-ion/lithium polymer rechargeable battery with a high-precision voltage detection circuit.

The AP9101C provides a function to protect batteries by detecting overcharge voltage, overdischarge voltage, overcharge current, overdischarge current and other abnormalities and turning off the external MOSFET switch.

The AP9101C also has a built-in fixed time circuit (external capacitors are unnecessary); the protection circuitry can be comprised with fewer external components.

The AP9101C is available in standard packages of SOT25 and SOT26.

## Applications

- Lithium-Ion Battery Packs
- Lithium Polymer Battery Packs

## Features

- Low Current Consumption (+25°C)
  - Operation Mode: 3.0µA (Typ)  $V_{DD} = 3.5V$
  - Power-Down Mode: 0.01µA (Typ)
- High-Accuracy Voltage Detection Circuit (+25°C)
  - Overcharge Detection Voltage: 3.5V to 4.5V (5mV Steps) Accuracy  $\pm 25mV$
  - Overcharge Hysteresis Voltage Range: 0.1V to 0.4V (50mV Steps) Accuracy  $\pm 50mV$
  - Overdischarge Detection Voltage: 2.0V to 3.4V (10mV Steps) Accuracy  $\pm 35mV$
  - Overdischarge Hysteresis Voltage Range: 0V to 0.7V (40mV Steps) Accuracy  $\pm 65mV$
  - Discharge Overcurrent Detection Voltage: 0.05V to 0.32V (10mV Steps) Accuracy  $\pm 15mV$
  - Short Current Detection Voltage: 0.45V to 0.7V (50mV Steps) Accuracy  $\pm 100mV$
  - Charge Overcurrent Detection Voltage: -0.2V to -0.05V (10mV Steps) Accuracy  $\pm 15mV$
  - Overcharger Detection Voltage: 8.0V (Fixed) Accuracy  $\pm 2V$
  - Overcharger Release Voltage: 7.3V (Fixed) Accuracy  $\pm 2V$
- Built-In Fixed Detection Delay Time (+25°C): Accuracy  $\pm 20\%$
- Power-Down Mode can be Selectable: Available/Unavailable
- 0V Battery Charge Function can be Selectable: Available/Unavailable
- Overcharge Protection Mode: Release
- High-Voltage CMOS Process: Up to 30V between  $V_{DD}$  and  $V_M$  Pins
- **Totally Lead-free & Fully RoHS Compliant (Note 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

## Pin Assignments



- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

**Typical Applications Circuit** (Note 4)



Note: 4. R1 and C1 are used to stabilize the supply voltage of the AP9101C. The recommended range of R1 value is 330Ω to 470Ω and C1 value is 10nF to 1000nF, typical value is 100nF. R2 should be connected between P- to VM sense terminal to monitor the status of charger and the charge/discharge current. The R2 should be between 300Ω and 4kΩ, typical value is 2.7kΩ. R1 and R2 are also used as current limit resistors if the battery or charger is connected reversely. Polarity reversing may cause the power consumption of R1 and R2 to go over their power dissipation rating, therefore R1 and R2 values should be selected appropriately for the actual application. If R2 is more than 4kΩ resistor, CO may not cut off Q2 due to the voltage drop on R2.

For power-down mode, when first connecting AP9101C system board to the battery, it is necessary to use charger or to short P- to the battery negative polarity. Once the AP9101C is activated, the charger or connection can be removed, otherwise the battery cannot discharge current through the system board.

The values selected should follow the recommended typical range mentioned above.

**Pin Descriptions**

| Pin Number |       | Pin Name | Function                           |
|------------|-------|----------|------------------------------------|
| SOT25      | SOT26 |          |                                    |
| 1          | 2     | VM       | Charger Negative Input Pin         |
| 2          | 5     | VDD      | Positive Power Input Pin           |
| 3          | 6     | VSS      | Negative Power Input Pin           |
| 4          | 1     | DO       | FET Gate Control Pin for Discharge |
| 5          | 3     | CO       | FET Gate Control Pin for charge    |
| —          | 4     | NC       | Not Connected                      |

**Functional Block Diagram**



A(B)  
A for SOT25  
B for SOT26

## Absolute Maximum Ratings (Note 5)

| Symbol     | Parameter   | Rating                       | Unit |
|------------|---|------------------------------|------|
| $V_{DS}$   | Supply Voltage (Between $V_{DD}$ and $V_{SS}$ )     | -0.3 to 12                   | V    |
| $V_{DM}$   | Charger Input Voltage (Between $V_{DD}$ and $V_M$ ) | -0.3 to 30                   | V    |
| $V_{CO}$   | CO Pin Output Voltage                               | $V_M-0.3$ to $V_{DD}+0.3$    | V    |
| $V_{DO}$   | DO Pin Output Voltage                               | $V_{SS}-0.3$ to $V_{DD}+0.3$ | V    |
| $T_{OPR}$  | Operating Temperature Range                         | -40 to +85                   | °C   |
| $T_J$      | Junction Temperature                                | +150                         | °C   |
| $T_{STG}$  | Storage Temperature Range                           | -65 to +150                  | °C   |
| $T_{LEAD}$ | Lead Temperature (Soldering, 10sec)                 | +300                         | °C   |
| $P_D$      | Power Dissipation (+25°C)                           | 250                          | mW   |
| —          | ESD (Machine Model)                                 | 200                          | V    |
| —          | ESD (Human Body Model)                              | 2,000                        | V    |

Note: 5. Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

## Recommended Operating Conditions

| Symbol   | Parameter   | Min  | Max | Unit |
|----------|---|------|-----|------|
| $V_{DS}$ | Supply Voltage (Between $V_{DD}$ and $V_{SS}$ )     | 1.5  | 5.5 | V    |
| $V_{DM}$ | Charger Input Voltage (Between $V_{DD}$ and $V_M$ ) | -0.3 | 5.5 | V    |
| $T_A$    | Operating Ambient Temperature                       | -40  | +85 | °C   |

## Electrical Characteristics

( $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 3.5\text{V}$ ,  $V_{SS} = 0\text{V}$ ,  $R_1 = 330\Omega$ ,  $R_2 = 2.7\text{k}\Omega$ ,  $C_1 = 100\text{nF}$ , unless otherwise specified.)

| Symbol       | Parameter                                     | Test Conditions   | Min  | Typ         | Max                    | Unit             |               |
|--------------|---|---|--|-------------|------------------------|------------------|---------------|
| $V_{CU}$     | Overcharge Detection Voltage                  | $V_M = 0$   | $V_{CU}-0.025$   | $V_{CU}$    | $V_{CU}+0.025$         | V                |               |
| $V_{CL}$     | Overcharge Release Voltage                    | $V_{CL} \neq V_{CU}$ , $V_M = 0$                                    | $V_{CL}-0.050$   | $V_{CL}$    | $V_{CL}+0.050$         | V                |               |
|              |   | $V_{CL} = V_{CU}$   | $V_{CL}-0.025$   | $V_{CL}$    | $V_{CL}+0.025$         | V                |               |
| $V_{DL}$     | Overdischarge Detection Voltage               | $V_M = 0$   | $V_{DL}-0.035$   | $V_{DL}$    | $V_{DL}+0.035$         | V                |               |
| $V_{DU}$     | Overdischarge Release Voltage                 | $V_{DU} \neq V_{DL}$ , $V_M = 0$                                    | $V_{DU}-0.100$   | $V_{DU}$    | $V_{DU}+0.100$         | V                |               |
|              |   | $V_{DU} = V_{DL}$   | $V_{DU}-0.035$   | $V_{DU}$    | $V_{DU}+0.035$         | V                |               |
| $V_{DOC}$    | Discharge Overcurrent Detection Voltage       | —   | $V_{DOC}-0.015$  | $V_{DOC}$   | $V_{DOC}+0.015$        | V                |               |
| $V_{SHORT}$  | Load Short-Circuiting Detection Voltage       | —   | $V_{SHORT}-0.10$   | $V_{SHORT}$ | $V_{SHORT}+0.10$       | V                |               |
| $V_{COC}$    | Charge Overcurrent Detection Voltage          | —   | $V_{COC}-0.015$  | $V_{COC}$   | $V_{COC}+0.015$        | V                |               |
| $I_{CC}$     | Current Consumption during Operation          | $V_{DD} = 3.5\text{V}$ , $V_M = 0\text{V}$                          | 1.5  | 3           | 4.5                    | $\mu\text{A}$    |               |
| $I_{STB}$    | Current Consumption at Power-Down             | $V_{DD}=1.8\text{V}$ ,<br>$V_M$ Pin Floating                        | Power-Down Mode<br>Without Power-Down<br>Mode (Auto-Wake-up) | —           | —                      | 0.1              | $\mu\text{A}$ |
|              |   |   |  | —           | —                      | 5.5              |               |
| $R_{COH}$    | CO Pin Resistance "H"                         | $V_{DD} = 3.5\text{V}$ , $V_{CO} = 3.0\text{V}$ , $V_M = 0\text{V}$ | 2  | 6           | 10                     | $\text{k}\Omega$ |               |
| $R_{COL}$    | CO Pin Resistance "L"                         | $V_{DD} = 4.5\text{V}$ , $V_{CO} = 0.5\text{V}$ , $V_M = 0\text{V}$ | 2  | 4           | 10                     | $\text{k}\Omega$ |               |
| $R_{DOH}$    | DO Pin Resistance "H"                         | $V_{DD} = 3.5\text{V}$ , $V_{DO} = 3.0\text{V}$ , $V_M = 0\text{V}$ | 2  | 5           | 10                     | $\text{k}\Omega$ |               |
| $R_{DOL}$    | DO Pin Resistance "L"                         | $V_{DD} = 1.8\text{V}$ , $V_{DO} = 0.5\text{V}$ , $V_M = 0\text{V}$ | 2  | 5           | 10                     | $\text{k}\Omega$ |               |
| $R_{VMD}$    | Resistance between $V_M$ Pin and $V_{DD}$ Pin | $V_{DD} = 1.8\text{V}$ , $V_M = 0\text{V}$                          | 150  | 300         | 500                    | $\text{k}\Omega$ |               |
| $R_{VMS}$    | Resistance between $V_M$ Pin and $V_{SS}$ Pin | $V_{DD} = 3.5\text{V}$ , $V_M = 1.0\text{V}$                        | 10   | 30          | 50                     | $\text{k}\Omega$ |               |
| $V_{0CHA}$   | 0V Battery Charge Starting Charger Voltage    | 0V Battery Charging "Available"                                     | 1.2  | —           | —                      | V                |               |
| $V_{0INH}$   | 0V Battery Charge Inhibition Battery Voltage  | 0V Battery Charging "Unavailable"                                   | —  | —           | 0.45                   | V                |               |
| $V_{OVCHG}$  | Overvoltage Charger Detection Voltage         | $V_{DD} = 3.5\text{V}$  | 6.0  | 8.0         | 10.0                   | V                |               |
| $V_{OVCHGR}$ | Overvoltage Charger Release Voltage           | $V_{DD} = 3.5\text{V}$  | 5.3  | 7.3         | 9.3                    | V                |               |
| $t_{CU}$     | Overcharge Detection Delay Time               | —   | $t_{CU} \times 0.8$  | $t_{CU}$    | $t_{CU} \times 1.2$    | ms               |               |
| $t_{DL}$     | Overdischarge Detection Delay Time            | —   | $t_{DL} \times 0.8$  | $t_{DL}$    | $t_{DL} \times 1.2$    | ms               |               |
| $t_{DOC}$    | Discharge Overcurrent Detection Delay Time    | —   | $t_{DOC} \times 0.8$   | $t_{DOC}$   | $t_{DOC} \times 1.2$   | ms               |               |
| $t_{SHORT}$  | Load Short-Circuiting Detection Delay Time    | —   | $t_{SHORT} \times 0.8$                                       | $t_{SHORT}$ | $t_{SHORT} \times 1.2$ | $\mu\text{s}$    |               |
| $t_{COC}$    | Charge Overcurrent Detection Delay Time       | —   | $t_{COC} \times 0.8$   | $t_{COC}$   | $t_{COC} \times 1.2$   | ms               |               |

**Electrical Characteristics** (Continued)

 (T<sub>A</sub> = -40°C to +85°C, V<sub>DD</sub> = 3.5V, V<sub>SS</sub> = 0V, R<sub>1</sub> = 330Ω, R<sub>2</sub> = 2.7kΩ, C<sub>1</sub> = 100nF, unless otherwise specified.)

| Symbol              | Parameter   | Test Conditions   | Min                                    | Typ                | Max                      | Unit |    |
|---------------------|---|---|--|--------------------|--------------------------|------|----|
| V <sub>CU</sub>     | Overcharge Detection Voltage                                  | V <sub>M</sub> = 0  | V <sub>CU</sub> -0.060                 | V <sub>CU</sub>    | V <sub>CU</sub> +0.040   | V    |    |
| V <sub>CL</sub>     | Overcharge Release Voltage                                    | V <sub>CL</sub> ≠ V <sub>CU</sub> , V <sub>M</sub> = 0              | V <sub>CL</sub> -0.080                 | V <sub>CL</sub>    | V <sub>CL</sub> +0.065   | V    |    |
|                     |   | V <sub>CL</sub> = V <sub>CU</sub>                                   | V <sub>CL</sub> -0.060                 | V <sub>CL</sub>    | V <sub>CL</sub> +0.040   | V    |    |
| V <sub>DL</sub>     | Overdischarge Detection Voltage                               | V <sub>M</sub> = 0  | V <sub>DL</sub> -0.110                 | V <sub>DL</sub>    | V <sub>DL</sub> +0.130   | V    |    |
| V <sub>DU</sub>     | Overdischarge Release Voltage                                 | V <sub>DU</sub> ≠ V <sub>DL</sub> , V <sub>M</sub> = 0              | V <sub>DU</sub> -0.150                 | V <sub>DU</sub>    | V <sub>DU</sub> +0.190   | V    |    |
|                     |   | V <sub>DU</sub> = V <sub>DL</sub>                                   | V <sub>DU</sub> -0.110                 | V <sub>DU</sub>    | V <sub>DU</sub> +0.130   | V    |    |
| V <sub>DOC</sub>    | Discharge Overcurrent Detection Voltage                       | —   | V <sub>DOC</sub> -0.021                | V <sub>DOC</sub>   | V <sub>DOC</sub> +0.024  | V    |    |
| V <sub>SHORT</sub>  | Load Short-Circuiting Detection Voltage                       | —   | V <sub>SHORT</sub> -0.34               | V <sub>SHORT</sub> | V <sub>SHORT</sub> +0.34 | V    |    |
| V <sub>COC</sub>    | Charge Overcurrent Detection Voltage                          | —   | V <sub>COC</sub> -0.040                | V <sub>COC</sub>   | V <sub>COC</sub> +0.040  | V    |    |
| I <sub>CC</sub>     | Current Consumption during Operation                          | V <sub>DD</sub> = 3.5V, V <sub>M</sub> = 0V                         | 1.0                                    | 3.0                | 7.0                      | μA   |    |
| I <sub>STB</sub>    | Current Consumption at Power-Down                             | V <sub>DD</sub> = 1.8V, V <sub>M</sub> Pin Floating                 | Power-Down Mode                        | —                  | —                        | 1.0  | μA |
|                     |   |   | Without Power-Down Mode (Auto-Wake-up) | —                  | —                        | 8    |    |
| R <sub>COH</sub>    | CO Pin Resistance "H"   | V <sub>DD</sub> = 3.5V, V <sub>CO</sub> = 3.0V, V <sub>M</sub> = 0V | 1.2                                    | 6                  | 15                       | kΩ   |    |
| R <sub>COL</sub>    | CO Pin Resistance "L"   | V <sub>DD</sub> = 4.5V, V <sub>CO</sub> = 0.5V, V <sub>M</sub> = 0V | 1.2                                    | 4                  | 15                       | kΩ   |    |
| R <sub>DOH</sub>    | DO Pin Resistance "H"   | V <sub>DD</sub> = 3.5V, V <sub>DO</sub> = 3.0V, V <sub>M</sub> = 0V | 1.2                                    | 5                  | 15                       | kΩ   |    |
| R <sub>DOL</sub>    | DO Pin Resistance "L"   | V <sub>DD</sub> = 1.8V, V <sub>DO</sub> = 0.5V, V <sub>M</sub> = 0V | 1.2                                    | 5                  | 15                       | kΩ   |    |
| R <sub>VMD</sub>    | Resistance between V <sub>M</sub> Pin and V <sub>DD</sub> Pin | V <sub>DD</sub> = 1.8V, V <sub>M</sub> = 0V                         | 100                                    | 300                | 650                      | kΩ   |    |
| R <sub>VMS</sub>    | Resistance between V <sub>M</sub> Pin and V <sub>SS</sub> Pin | V <sub>DD</sub> = 3.5V, V <sub>M</sub> = 1.0V                       | 5                                      | 30                 | 65                       | kΩ   |    |
| V <sub>0CHA</sub>   | 0V Battery Charge Starting Charger Voltage                    | 0V Battery Charging "Available"                                     | 1.2                                    | —                  | —                        | V    |    |
| V <sub>0INH</sub>   | 0V Battery Charge Inhibition Battery Voltage                  | 0V Battery Charging "Unavailable"                                   | —                                      | —                  | 0.3                      | V    |    |
| V <sub>OVCHG</sub>  | Overvoltage Charger Detection Voltage                         | V <sub>DD</sub> = 3.5V  | 5.5                                    | 8.0                | 10.5                     | V    |    |
| V <sub>OVCHGR</sub> | Overvoltage Charger Release Voltage                           | V <sub>DD</sub> = 3.5V  | 5.0                                    | 7.3                | 9.5                      | V    |    |
| t <sub>CU</sub>     | Overcharge Detection Delay Time                               | —   | t <sub>CU</sub> ×0.6                   | t <sub>CU</sub>    | t <sub>CU</sub> ×1.4     | ms   |    |
| t <sub>DL</sub>     | Overdischarge Detection Delay Time                            | —   | t <sub>DL</sub> ×0.6                   | t <sub>DL</sub>    | t <sub>DL</sub> ×1.4     | ms   |    |
| t <sub>DOC</sub>    | Discharge Overcurrent Detection Delay Time                    | —   | t <sub>DOC</sub> ×0.6                  | t <sub>DOC</sub>   | t <sub>DOC</sub> ×1.4    | ms   |    |
| t <sub>SHORT</sub>  | Load Short-Circuiting Detection Delay Time                    | —   | t <sub>SHORT</sub> ×0.6                | t <sub>SHORT</sub> | t <sub>SHORT</sub> ×1.4  | μs   |    |
| t <sub>COC</sub>    | Charge Overcurrent Detection Delay Time                       | —   | t <sub>COC</sub> ×0.6                  | t <sub>COC</sub>   | t <sub>COC</sub> ×1.4    | ms   |    |

## Operation Description

### Operation Mode

#### 1. Normal Status

The AP9101C monitors the battery voltage between the  $V_{DD}$  Pin and  $V_{SS}$  Pin as well as the voltage difference between the  $V_M$  Pin and  $V_{SS}$  Pin to control battery charging and discharging by the CO and DO Pins. When the battery voltage is between overdischarge detection voltage ( $V_{DL}$ ) and overcharge detection voltage ( $V_{CU}$ )—as well as the  $V_M$  Pin voltage being between the charge overcurrent detection voltage ( $V_{COC}$ ) and discharge overcurrent detection voltage ( $V_{DOC}$ )—the CO and DO Pin of the AP9101C will output high level and turn on charge and discharge MOSFETs. In these conditions, the battery can charge and discharge freely. Also,  $R_{VMD}$  and  $R_{VMS}$  do not connect to  $V_{DD}$  and  $V_{SS}$  Pins in this status.

#### 2. Overcharge Status

If the battery voltage is more than  $V_{CU}$  during charging status for the overcharge detection delay time ( $t_{CU}$ ) or longer, the AP9101C turns off the charge MOSFET by setting low level to the CO Pin to stop charging.  $R_{VMD}$  and  $R_{VMS}$  are not connected in overcharge status.

When the  $V_M$  Pin voltage is lower than  $V_{DOC}$  and battery voltage falls below  $V_{CL}$ , the AP9101C will release from overcharge status.

When the  $V_M$  Pin voltage is equal to or more than  $V_{DOC}$  and battery voltage falls below  $V_{CU}$ , the AP9101C will release from overcharge status.

#### 3. Overdischarge Status

If the battery voltage is less than  $V_{DL}$  during discharging status for the overdischarge detection delay time ( $t_{DL}$ ) or longer, the AP9101C turns off the discharge MOSFET by setting low level to the DO Pin to stop discharging. In overdischarge status,  $R_{VMD}$  is connected to  $V_{DD}$ , and the  $V_M$  Pin voltage is pulled up to  $V_{DD}$  by  $R_{VMD}$ , but  $R_{VMS}$  is not connected. For standby version, the AP9101C recovers normal status from overdischarge status only by charging the battery through the charger.

When the  $V_M$  Pin voltage to the  $V_{SS}$  Pin voltage is less than typical -0.7V and the battery voltage rises over  $V_{DL}$ , the AP9101C will release from overdischarge status. If the  $V_M$  Pin voltage to the  $V_{SS}$  Pin voltage is higher than typical -0.7V, the AP9101C will release from overdischarge status until the battery voltage rises over  $V_{DU}$ .

For auto-wake-up version AP9101CA, the device recovers to normal status from overdischarge status if either of these two conditions are satisfied.

If charger is connected: the AP9101CA overdischarge status is released in the same way as described above in AP9101C Overdischarge Status section.

If no charger is connected: 1) the battery voltage reaches the overdischarge release voltage ( $V_{DU}$ ) or higher;  
2) maintains continuous time more than overdischarge release delay time  $t_{DLR}$ .

#### 4. Discharge Overcurrent and Short Current Status

When the battery is in discharge overcurrent status, if the voltage of the  $V_M$  Pin to  $V_{SS}$  Pin is equal or more than  $V_{DOC}$  to  $V_{SHORT}$ , for the overdischarge current detection delay time ( $t_{DOC}$ ) or longer, the AP9101C turns off the discharge MOSFET by setting low level to the DO pin to stop discharging.

When the battery is in short current status, if the voltage of the  $V_M$  Pin to  $V_{SS}$  Pin is equal to or more than  $V_{SHORT}$ , for the short current detection delay time or longer, the AP9101C turns off the discharge MOSFET by setting low level to the DO pin to stop discharging.

In discharge overcurrent or short current status,  $R_{VMS}$  is connected to  $V_{SS}$  but  $R_{VMD}$  is not connected. The voltage of  $V_M$  Pin is almost equal to  $V_{DD}$  as long as the load is connected. When the load is disconnected, the voltage of  $V_M$  Pin will become almost equal to  $V_{SS}$  (due to  $R_{VMS}$  being connected) then the AP9101C will release from discharge overcurrent or short current status.

#### 5. Charge Overcurrent Status

When the battery is in charge overcurrent status, if the voltage of the  $V_M$  Pin to  $V_{SS}$  Pin is equal to or less than  $V_{COC}$ , for the charge overcurrent detection delay time ( $t_{COC}$ ) or longer, the AP9101C turns off the charge MOSFET by setting low level to the CO pin to stop charging.

---

**Operation Description** (Continued)

---

**6. 0V Battery Charging Function (Option)**

This function is available as an option and can be factory set internally. AP9101C has this function built in.

0V charging function permits charger to recharge the battery whose voltage is 0V due to self-discharge. If 0V charging function is not present, the device will prevent the charger to recharge the battery whose voltage is 0V due to self-discharge. (If a device without 0V charging function is needed, please contact Diodes sales team).

**7. Overvoltage Charger Detection Circuit**

This function is used to monitor the charger voltage between the  $V_{DD}$  Pin and  $V_M$  Pin, and when this voltage exceeds overvoltage charger detection voltage (8.0V Typ.), the AP9101C will set the CO Pin low level to turn off charge MOSFET. When this voltage drops below overvoltage charger release voltage (7.3V Typ.), the CO Pin will be set to high level and turn on charge MOSFET. There are no delay times set for detection and release.

**8. Power-Down Mode or Auto-Wake-Up Function (Option)**

In the device with power-down function, during power-down mode, the device enters the overdischarge status. The IC enters sleep mode and the current consumption becomes very low, typically 0.1  $\mu$ A. To release from power-down status to normal status, charger connection is required.

In the device with auto-wake-up mode, the IC remains active in the overdischarge state. The IC is released into normal state by the operation that increases the battery voltage more than the overdischarge release voltage.



**Time Chart**

(1) Overcharge and Overdischarge Detection



1:  $t_{DL}$   
2:  $t_{CU}$

S1: Charger connection  
S2: Load connection

**Time Chart** (Continued)

(2) Discharge Overcurrent Detection



1:  $t_{DOC}$   
2:  $t_{SHORT}$

S1: Connect over current load  
S2: Connect short current load

**Time Chart** (Cont.)

(3) Charge Overcurrent Detection



1:  $t_{coc}$

S1: Connect over current charger

## Ordering Information



### Voltage and Delay Time Combination

| Part Number       | Overcharge Detection Voltage<br>VCU | Overcharge Release Voltage<br>VCL | Over-discharge Detection Voltage<br>VDL | Over-discharge Release Voltage<br>VDU | Discharge Overcurrent Detection Voltage<br>VDOC | Load Short Detection Voltage<br>VSHORT | Charge Overcurrent Detection Voltage<br>VCOC | Over Voltage Charger Detection Voltage<br>VOVCHG | Over Voltage Charger Release Voltage<br>VOVCHGR | Power-Down Function | Overcharge Protection Mode | Delay Time | 0V Battery Charge Function |
|-------------------|-------------------------------------|-----------------------------------|---|---------------------------------------|---|--|--|--|---|---------------------|----------------------------|------------|----------------------------|
| AP9101Cxxx-AATRG1 | 4.375V                              | 4.175V                            | 2.500V                                  | 2.900V                                | 0.150V  | 0.700V                                 | -0.150V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-ABTRG1 | 4.425V                              | 4.225V                            | 2.500V                                  | 2.900V                                | 0.150V  | 0.700V                                 | -0.150V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-ACTRG1 | 4.375V                              | 4.175V                            | 2.500V                                  | 2.900V                                | 0.095V  | 0.700V                                 | -0.095V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-ADTRG1 | 4.375V                              | 4.175V                            | 2.500V                                  | 2.900V                                | 0.120V  | 0.700V                                 | -0.120V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-AETRG1 | 4.200V                              | 4.100V                            | 2.500V                                  | 3.000V                                | 0.300V  | 0.550V                                 | -0.100V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-AFTRG1 | 4.375V                              | 4.175V                            | 2.500V                                  | 2.900V                                | 0.180V  | 0.700V                                 | -0.180V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-AGTRG1 | 4.375V                              | 4.175V                            | 2.500V                                  | 2.900V                                | 0.075V  | 0.700V                                 | -0.075V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-AHTRG1 | 4.425V                              | 4.225V                            | 2.500V                                  | 2.900V                                | 0.075V  | 0.700V                                 | -0.075V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-AITRG1 | 4.500V                              | 4.300V                            | 2.400V                                  | 2.800V                                | 0.150V  | 0.700V                                 | -0.075V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-AJTRG1 | 4.375V                              | 4.175V                            | 2.400V                                  | 2.800V                                | 0.125V  | 0.700V                                 | -0.125V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-AKTRG1 | 4.250V                              | 4.050V                            | 2.400V                                  | 3.000V                                | 0.150V  | 0.700V                                 | -0.150V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-ALTRG1 | 4.275V                              | 4.175V                            | 2.300V                                  | 2.400V                                | 0.180V  | 0.700V                                 | -0.180V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-AMTRG1 | 4.375V                              | 4.175V                            | 2.300V                                  | 2.400V                                | 0.180V  | 0.700V                                 | -0.180V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-ANTRG1 | 4.225V                              | 4.025V                            | 3.200V                                  | 3.400V                                | 0.060V  | 0.450V                                 | -0.060V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-AOTRG1 | 4.425V                              | 4.225V                            | 2.500V                                  | 2.900V                                | 0.064V  | 0.450V                                 | -0.073V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-ASTRG1 | 3.800V                              | 3.700V                            | 2.300V                                  | 2.400V                                | 0.180V  | 0.700V                                 | -0.180V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |
| AP9101Cxxx-ATTRG1 | 4.400V                              | 4.200V                            | 2.800V                                  | 3.000V                                | 0.150V  | 0.700V                                 | -0.200V                                      | 8.0V   | 7.3V  | Selectable          | Auto Release               | Option 1   | Permission                 |

### Ordering Information (Continued)

|                   |        |        |        |        |        |        |         |      |      |            |              |          |             |
|-------------------|--------|--------|--------|--------|--------|--------|---------|------|------|------------|--------------|----------|-------------|
| AP9101Cxxx-AUTRG1 | 4.300V | 4.100V | 2.500V | 2.900V | 0.100V | 0.700V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-AXTRG1 | 4.280V | 4.080V | 2.800V | 2.800V | 0.100V | 0.500V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-AYTRG1 | 4.275V | 4.075V | 2.800V | 2.900V | 0.150V | 0.500V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Prohibition |
| AP9101Cxxx-AZTRG1 | 4.275V | 4.075V | 2.500V | 2.900V | 0.150V | 0.500V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Prohibition |
| AP9101Cxxx-BATRG1 | 4.475V | 4.275V | 2.500V | 2.900V | 0.150V | 0.500V | -0.150V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BBTRG1 | 4.475V | 4.275V | 2.500V | 2.900V | 0.200V | 0.500V | -0.200V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BCTRG1 | 4.465V | 4.265V | 2.100V | 2.100V | 0.150V | 0.500V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BDTRG1 | 4.425V | 4.225V | 2.500V | 2.500V | 0.160V | 0.500V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BETRG1 | 4.425V | 4.225V | 2.500V | 2.500V | 0.160V | 0.500V | -0.160V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BFTRG1 | 4.425V | 4.225V | 2.500V | 2.800V | 0.160V | 0.500V | -0.150V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BGTRG1 | 4.425V | 4.225V | 2.500V | 2.800V | 0.200V | 0.500V | -0.150V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BHTRG1 | 4.425V | 4.225V | 2.500V | 2.900V | 0.200V | 0.500V | -0.200V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BITRG1 | 4.425V | 4.225V | 2.500V | 2.900V | 0.130V | 0.500V | -0.130V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BJTRG1 | 4.400V | 4.300V | 3.000V | 3.200V | 0.250V | 0.600V | -0.200V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BKTRG1 | 4.400V | 4.200V | 2.800V | 3.000V | 0.150V | 0.600V | -0.200V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Prohibition |
| AP9101Cxxx-BLTRG1 | 4.380V | 4.280V | 2.600V | 2.800V | 0.150V | 0.600V | -0.175V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BMTRG1 | 4.375V | 4.175V | 2.300V | 2.400V | 0.150V | 0.600V | -0.150V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BNTRG1 | 4.325V | 4.075V | 2.500V | 2.900V | 0.150V | 0.600V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Prohibition |
| AP9101Cxxx-BOTRG1 | 4.325V | 4.075V | 2.500V | 2.900V | 0.150V | 0.500V | -0.150V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Prohibition |
| AP9101Cxxx-BPTRG1 | 4.325V | 4.125V | 2.500V | 2.800V | 0.150V | 0.600V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BQTRG1 | 4.300V | 4.100V | 2.300V | 2.300V | 0.250V | 0.600V | -0.100  | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BRTRG1 | 4.280V | 4.080V | 3.000V | 3.300V | 0.080V | 0.500V | -0.080V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BSTRG1 | 4.280V | 4.080V | 3.000V | 3.300V | 0.080V | 0.500V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BTTRG1 | 4.280V | 4.080V | 2.300V | 2.300V | 0.160v | 0.500v | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BUTRG1 | 4.280V | 4.080V | 2.300V | 2.300V | 0.125V | 0.600V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |

### Ordering Information (Cont.)

|                   |        |        |        |        |        |        |         |      |      |            |              |          |             |
|-------------------|--------|--------|--------|--------|--------|--------|---------|------|------|------------|--------------|----------|-------------|
| AP9101Cxxx-BVTRG1 | 4.280V | 4.080V | 2.800V | 3.000V | 0.100V | 0.500V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BWTRG1 | 4.280V | 4.180V | 3.000V | 3.000V | 0.180V | 0.600  | -0.150V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BXTRG1 | 4.280V | 4.180V | 2.800V | 2.800V | 0.050V | 0.600V | -0.050V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BYTRG1 | 4.280V | 4.180V | 2.800V | 2.800V | 0.250V | 0.600V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-BZTRG1 | 4.280V | 4.130V | 2.800V | 3.100V | 0.100V | 0.500V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CATR1  | 4.275V | 4.175V | 2.300V | 2.800V | 0.250V | 0.600V | -0.200V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CBTRG1 | 4.275V | 4.175V | 2.300V | 2.400V | 0.200V | 0.500V | -0.200V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CCTR1  | 4.275V | 4.075V | 2.500V | 2.900V | 0.150V | 0.500V | -0.150V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Prohibition |
| AP9101Cxxx-CDTRG1 | 4.275V | 4.075V | 2.300V | 2.300V | 0.150V | 0.600V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CETRG1 | 4.275V | 4.175V | 2.300V | 2.400V | 0.100V | 0.600V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CFTRG1 | 4.275V | 4.075V | 2.800V | 2.800V | 0.150V | 0.600V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CGTRG1 | 4.275V | 4.075V | 2.800V | 3.000V | 0.150V | 0.600V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CHTRG1 | 4.250V | 4.150V | 2.500V | 2.700V | 0.250V | 0.600V | -0.200V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CITRG1 | 4.250V | 4.150V | 2.700V | 3.000V | 0.250V | 0.600V | -0.200V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CJTRG1 | 4.250V | 4.050V | 2.500V | 2.800V | 0.200V | 0.600V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CKTRG1 | 4.250V | 4.150V | 2.800V | 3.000V | 0.150V | 0.600V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CLTRG1 | 4.250V | 4.150V | 2.500V | 3.000V | 0.150V | 0.600V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CMTRG1 | 4.200V | 4.100V | 2.800V | 3.000V | 0.150V | 0.550V | -0.150V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Prohibition |
| AP9101Cxxx-CNTRG1 | 4.200V | 4.100V | 2.500V | 2.500V | 0.150V | 0.600V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-COTRG1 | 4.190V | 4.090V | 2.700V | 3.000V | 0.100V | 0.600V | -0.050V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Prohibition |
| AP9101Cxxx-CPTRG1 | 3.650V | 3.450V | 2.100V | 2.300V | 0.150V | 0.550V | -0.150V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Permission  |
| AP9101Cxxx-CQTRG1 | 4.250V | 4.050V | 2.800V | 3.000V | 0.150V | 0.500V | -0.100V | 8.0V | 7.3V | Selectable | Auto Release | Option 1 | Prohibition |

---

**Ordering Information** (Cont.)
 

---

**Delay Time Option Overview**

| Delay Time Option | Overcharge Detection DelayTime (t <sub>CU</sub> ) | Overdischarge Detection Delay Time (t <sub>DL</sub> ) | Overdischarge Current Detection Delay Time (t <sub>DOC</sub> ) | Overcharge Current Detection Delay Time (t <sub>COC</sub> ) | Load Short Circuiting Detection Delay Time (t <sub>SHORT</sub> ) |
|-------------------|---|---|--|---|--|
| 1                 | 1,000ms   | 115ms   | 10ms   | 10ms  | 320μs  |
| 2                 | 125ms   | 32ms  | 8ms  | 8ms   | 160μs  |
| 3                 | 1,000ms   | 20ms  | 12ms   | 10ms  | 320μs  |
| 4                 | 1,000ms   | 42ms  | 10ms   | 10ms  | 320μs  |
| 5                 | 1,000ms   | 115ms   | 10ms   | 10ms  | 160μs  |

**Marking Information** (Note 6)

| Product           | Package | Part Number       | Marking ID | Packing Type |
|-------------------|---------|-------------------|------------|--------------|
|                   |         | Green             | Green      |              |
| AP9101C           | SOT25   | AP9101CK-AATR1G1  | GQA        | Tape & Reel  |
|                   |         | AP9101CK-ABTR1G1  | G6U        | Tape & Reel  |
|                   |         | AP9101CK-ACTR1G1  | GQJ        | Tape & Reel  |
|                   |         | AP9101CK-ADTR1G1  | GQK        | Tape & Reel  |
|                   |         | AP9101CK-AETR1G1  | GQD        | Tape & Reel  |
|                   |         | AP9101CK-AFTR1G1  | GQL        | Tape & Reel  |
|                   |         | AP9101CK-AGTR1G1  | GQM        | Tape & Reel  |
|                   |         | AP9101CK-AHTR1G1  | GQN        | Tape & Reel  |
|                   |         | AP9101CK-AITR1G1  | GQP        | Tape & Reel  |
|                   |         | AP9101CK-AJTR1G1  | GQQ        | Tape & Reel  |
|                   |         | AP9101CK-AKTR1G1  | GQG        | Tape & Reel  |
|                   |         | AP9101CK-ALTR1G1  | GQR        | Tape & Reel  |
|                   |         | AP9101CK-AMTR1G1  | GQS        | Tape & Reel  |
|                   |         | AP9101CK-ANTR1G1  | GQT        | Tape & Reel  |
|                   |         | AP9101CK-AOTR1G1  | GRT        | Tape & Reel  |
|                   |         | AP9101CK-ASTR1G1  | GQV        | Tape & Reel  |
|                   |         | AP9101CAK-AATR1G1 | GRA        | Tape & Reel  |
|                   |         | AP9101CAK-ABTR1G1 | GSC        | Tape & Reel  |
|                   |         | AP9101CAK-ACTR1G1 | GRJ        | Tape & Reel  |
|                   |         | AP9101CAK-ADTR1G1 | GRK        | Tape & Reel  |
|                   |         | AP9101CAK-AETR1G1 | GRD        | Tape & Reel  |
|                   |         | AP9101CAK-AFTR1G1 | GRL        | Tape & Reel  |
|                   |         | AP9101CAK-AGTR1G1 | GRM        | Tape & Reel  |
|                   |         | AP9101CAK-AHTR1G1 | GRN        | Tape & Reel  |
|                   |         | AP9101CAK-AITR1G1 | GRP        | Tape & Reel  |
|                   |         | AP9101CAK-AJTR1G1 | GRQ        | Tape & Reel  |
|                   |         | AP9101CAK-AKTR1G1 | GRG        | Tape & Reel  |
|                   |         | AP9101CAK-ALTR1G1 | GRR        | Tape & Reel  |
|                   |         | AP9101CAK-AMTR1G1 | GRS        | Tape & Reel  |
|                   |         | AP9101CAK-ANTR1G1 | GST        | Tape & Reel  |
|                   |         | AP9101CAK-AOTR1G1 | GTT        | Tape & Reel  |
|                   |         | AP9101CAK-ASTR1G1 | GSV        | Tape & Reel  |
| AP9101CAK-ATTR1G1 | GSW     | Tape & Reel       |            |              |

Note: 6. Current voltage versions are built by delay time option 1. If any other voltage versions or delay time option products are needed, please contact with the local sale's office.



### Marking Information (Continued)

|                   |       |                   |     |             |
|-------------------|-------|-------------------|-----|-------------|
| AP9101C           | SOT26 | AP9101CK6-AATR1G1 | GQB | Tape & Reel |
|                   |       | AP9101CK6-ABTR1G1 | GQC | Tape & Reel |
|                   |       | AP9101CK6-ACTR1G1 | GSJ | Tape & Reel |
|                   |       | AP9101CK6-ADTR1G1 | GSK | Tape & Reel |
|                   |       | AP9101CK6-AETR1G1 | GQE | Tape & Reel |
|                   |       | AP9101CK6-AFTR1G1 | GSL | Tape & Reel |
|                   |       | AP9101CK6-AGTR1G1 | GSM | Tape & Reel |
|                   |       | AP9101CK6-AHTR1G1 | GSN | Tape & Reel |
|                   |       | AP9101CK6-AITR1G1 | GSP | Tape & Reel |
|                   |       | AP9101CK6-AJTR1G1 | GSQ | Tape & Reel |
|                   |       | AP9101CK6-AKTR1G1 | GQH | Tape & Reel |
|                   |       | AP9101CK6-ALTR1G1 | GSR | Tape & Reel |
|                   |       | AP9101CK6-AMTR1G1 | GSS | Tape & Reel |
|                   |       | AP9101CK6-ANTR1G1 | GQU | Tape & Reel |
|                   |       | AP9101CK6-AOTR1G1 | GRU | Tape & Reel |
|                   |       | AP9101CK6-ASTR1G1 | GRW | Tape & Reel |
|                   |       | AP9101CK6-ATTR1G1 | GRV | Tape & Reel |
|                   |       | AP9101CK6-AUTR1G1 | GQW | Tape & Reel |
|                   |       | AP9101CK6-AXTR1G1 | GPU | Tape & Reel |
|                   |       | AP9101CK6-AYTR1G1 | GPV | Tape & Reel |
|                   |       | AP9101CK6-AZTR1G1 | GPW | Tape & Reel |
|                   |       | AP9101CK6-BATR1G1 | GXA | Tape & Reel |
|                   |       | AP9101CK6-BBTR1G1 | GXB | Tape & Reel |
|                   |       | AP9101CK6-BCTR1G1 | GXC | Tape & Reel |
|                   |       | AP9101CK6-BDTR1G1 | GXD | Tape & Reel |
|                   |       | AP9101CK6-BETR1G1 | GXE | Tape & Reel |
|                   |       | AP9101CK6-BFTR1G1 | GXF | Tape & Reel |
|                   |       | AP9101CK6-BGTR1G1 | GXG | Tape & Reel |
|                   |       | AP9101CK6-BHTR1G1 | GXH | Tape & Reel |
|                   |       | AP9101CK6-BITR1G1 | GXJ | Tape & Reel |
|                   |       | AP9101CK6-BJTR1G1 | GXK | Tape & Reel |
|                   |       | AP9101CK6-BKTR1G1 | GXL | Tape & Reel |
| AP9101CK6-BLTR1G1 | GXM   | Tape & Reel       |     |             |
| AP9101CK6-BMTR1G1 | GXN   | Tape & Reel       |     |             |
| AP9101CK6-BNTR1G1 | GXP   | Tape & Reel       |     |             |

### Marking Information (Cont.)

|                   |       |                   |     |             |
|-------------------|-------|-------------------|-----|-------------|
| AP9101C           | SOT26 | AP9101CK6-BOTRG1  | GXQ | Tape & Reel |
|                   |       | AP9101CK6-BPTRG1  | GXR | Tape & Reel |
|                   |       | AP9101CK6-BQTRG1  | GXS | Tape & Reel |
|                   |       | AP9101CK6-BRTRG1  | GXT | Tape & Reel |
|                   |       | AP9101CK6-BSTRG1  | GXU | Tape & Reel |
|                   |       | AP9101CK6-BTTRG1  | GXZ | Tape & Reel |
|                   |       | AP9101CK6-BUTRG1  | GXV | Tape & Reel |
|                   |       | AP9101CK6-BVTRG1  | GXW | Tape & Reel |
|                   |       | AP9101CK6-BWTRG1  | GYS | Tape & Reel |
|                   |       | AP9101CK6-BXTRG1  | GYT | Tape & Reel |
|                   |       | AP9101CK6-BYTRG1  | GYU | Tape & Reel |
|                   |       | AP9101CK6-BZTRG1  | GYV | Tape & Reel |
|                   |       | AP9101CK6-CATRG1  | GYA | Tape & Reel |
|                   |       | AP9101CK6-CBTRG1  | GYB | Tape & Reel |
|                   |       | AP9101CK6-CCTRG1  | GYC | Tape & Reel |
|                   |       | AP9101CK6-CDTRG1  | GYD | Tape & Reel |
|                   |       | AP9101CK6-CETRG1  | GYE | Tape & Reel |
|                   |       | AP9101CK6-CFTRG1  | GYF | Tape & Reel |
|                   |       | AP9101CK6-CGTRG1  | GYG | Tape & Reel |
|                   |       | AP9101CK6-CHTRG1  | GYH | Tape & Reel |
|                   |       | AP9101CK6-CITRG1  | GYJ | Tape & Reel |
|                   |       | AP9101CK6-CJTRG1  | GYK | Tape & Reel |
|                   |       | AP9101CK6-CKTRG1  | GYL | Tape & Reel |
|                   |       | AP9101CK6-CLTRG1  | GYM | Tape & Reel |
|                   |       | AP9101CK6-CMTRG1  | GYN | Tape & Reel |
|                   |       | AP9101CK6-CNTRG1  | GYP | Tape & Reel |
|                   |       | AP9101CK6-COTRG1  | GYQ | Tape & Reel |
|                   |       | AP9101CK6-CPTRG1  | GYR | Tape & Reel |
|                   |       | AP9101CK6-CQTRG1  | GYW | Tape & Reel |
|                   |       | AP9101CAK6-AATRG1 | GRB | Tape & Reel |
|                   |       | AP9101CAK6-ABTRG1 | GRC | Tape & Reel |
|                   |       | AP9101CAK6-ACTRG1 | GTJ | Tape & Reel |
|                   |       | AP9101CAK6-ADTRG1 | GTK | Tape & Reel |
| AP9101CAK6-AETRG1 | GRE   | Tape & Reel       |     |             |
| AP9101CAK6-AFTRG1 | GTL   | Tape & Reel       |     |             |
| AP9101CAK6-AGTRG1 | GTM   | Tape & Reel       |     |             |

**Marking Information** (Cont.)

|                   |       |                   |     |             |
|-------------------|-------|-------------------|-----|-------------|
| AP9101C           | SOT26 | AP9101CAK6-AHTRG1 | GTN | Tape & Reel |
|                   |       | AP9101CAK6-AITRG1 | GTP | Tape & Reel |
|                   |       | AP9101CAK6-AJTRG1 | GTQ | Tape & Reel |
|                   |       | AP9101CAK6-AKTRG1 | GRH | Tape & Reel |
|                   |       | AP9101CAK6-ALTRG1 | GTR | Tape & Reel |
|                   |       | AP9101CAK6-AMTRG1 | GTS | Tape & Reel |
|                   |       | AP9101CAK6-ANTRG1 | GSU | Tape & Reel |
|                   |       | AP9101CAK6-AOTRG1 | GTU | Tape & Reel |
|                   |       | AP9101CAK6-ASTRG1 | GTW | Tape & Reel |
|                   |       | AP9101CAK6-ATTRG1 | GTV | Tape & Reel |
|                   |       | AP9101CAK6-AUTRG1 | GUT | Tape & Reel |
|                   |       | AP9101CAK6-AXTRG1 | GUU | Tape & Reel |
|                   |       | AP9101CAK6-AYTRG1 | GUV | Tape & Reel |
|                   |       | AP9101CAK6-AZTRG1 | GUW | Tape & Reel |
|                   |       | AP9101CAK6-BATRG1 | GVA | Tape & Reel |
|                   |       | AP9101CAK6-BBTRG1 | GVB | Tape & Reel |
|                   |       | AP9101CAK6-BCTRG1 | GVC | Tape & Reel |
|                   |       | AP9101CAK6-BDTRG1 | GVD | Tape & Reel |
|                   |       | AP9101CAK6-BETRG1 | GVE | Tape & Reel |
|                   |       | AP9101CAK6-BFTRG1 | GVF | Tape & Reel |
|                   |       | AP9101CAK6-BGTRG1 | GVG | Tape & Reel |
|                   |       | AP9101CAK6-BHTRG1 | GVH | Tape & Reel |
|                   |       | AP9101CAK6-BITRG1 | GVJ | Tape & Reel |
|                   |       | AP9101CAK6-BJTRG1 | GVK | Tape & Reel |
|                   |       | AP9101CAK6-BKTRG1 | GVL | Tape & Reel |
|                   |       | AP9101CAK6-BLTRG1 | GVM | Tape & Reel |
|                   |       | AP9101CAK6-BMTRG1 | GVN | Tape & Reel |
|                   |       | AP9101CAK6-BNTRG1 | GVP | Tape & Reel |
|                   |       | AP9101CAK6-BOTRG1 | GVQ | Tape & Reel |
|                   |       | AP9101CAK6-BPTRG1 | GVR | Tape & Reel |
|                   |       | AP9101CAK6-BQTRG1 | GVS | Tape & Reel |
|                   |       | AP9101CAK6-BRTRG1 | GVT | Tape & Reel |
|                   |       | AP9101CAK6-BSTRG1 | GVU | Tape & Reel |
| AP9101CAK6-BTTRG1 | GVV   | Tape & Reel       |     |             |
| AP9101CAK6-BUTRG1 | GVW   | Tape & Reel       |     |             |
| AP9101CAK6-BVTRG1 | GWS   | Tape & Reel       |     |             |

**Marking Information** (Cont.)

|                   |       |                   |     |             |
|-------------------|-------|-------------------|-----|-------------|
| AP9101C           | SOT26 | AP9101CAK6-BWTRG1 | GWT | Tape & Reel |
|                   |       | AP9101CAK6-BXTRG1 | GWU | Tape & Reel |
|                   |       | AP9101CAK6-BYTRG1 | GWV | Tape & Reel |
|                   |       | AP9101CAK6-BZTRG1 | GWW | Tape & Reel |
|                   |       | AP9101CAK6-CATRG1 | GWA | Tape & Reel |
|                   |       | AP9101CAK6-CBTRG1 | GWB | Tape & Reel |
|                   |       | AP9101CAK6-CCTRG1 | GWC | Tape & Reel |
|                   |       | AP9101CAK6-CDTRG1 | GWD | Tape & Reel |
|                   |       | AP9101CAK6-CETRG1 | GWE | Tape & Reel |
|                   |       | AP9101CAK6-CFTRG1 | GWF | Tape & Reel |
|                   |       | AP9101CAK6-CGTRG1 | GWG | Tape & Reel |
|                   |       | AP9101CAK6-CHTRG1 | GWH | Tape & Reel |
|                   |       | AP9101CAK6-CITRG1 | GWJ | Tape & Reel |
|                   |       | AP9101CAK6-CJTRG1 | GWK | Tape & Reel |
|                   |       | AP9101CAK6-CKTRG1 | GWL | Tape & Reel |
|                   |       | AP9101CAK6-CLTRG1 | GWM | Tape & Reel |
|                   |       | AP9101CAK6-CMTRG1 | GWN | Tape & Reel |
|                   |       | AP9101CAK6-CNTRG1 | GWP | Tape & Reel |
|                   |       | AP9101CAK6-COTRG1 | GWQ | Tape & Reel |
| AP9101CAK6-CPTRG1 | GWR   | Tape & Reel       |     |             |

**Package Outline Dimensions**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**SOT25**



| SOT25                       |       |      |      |
|-----------------------------|-------|------|------|
| Dim                         | Min   | Max  | Typ  |
| A                           | 0.35  | 0.50 | 0.38 |
| B                           | 1.50  | 1.70 | 1.60 |
| C                           | 2.70  | 3.00 | 2.80 |
| D                           | -     | -    | 0.95 |
| H                           | 2.90  | 3.10 | 3.00 |
| J                           | 0.013 | 0.10 | 0.05 |
| K                           | 1.00  | 1.30 | 1.10 |
| L                           | 0.35  | 0.55 | 0.40 |
| M                           | 0.10  | 0.20 | 0.15 |
| N                           | 0.70  | 0.80 | 0.75 |
| α                           | 0°    | 8°   | -    |
| <b>All Dimensions in mm</b> |       |      |      |

**SOT26**

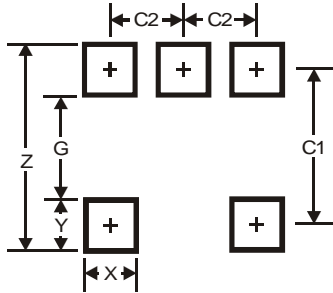


| SOT26                       |       |      |      |
|-----------------------------|-------|------|------|
| Dim                         | Min   | Max  | Typ  |
| A1                          | 0.013 | 0.10 | 0.05 |
| A2                          | 1.00  | 1.30 | 1.10 |
| A3                          | 0.70  | 0.80 | 0.75 |
| b                           | 0.35  | 0.50 | 0.38 |
| c                           | 0.10  | 0.20 | 0.15 |
| D                           | 2.90  | 3.10 | 3.00 |
| e                           | -     | -    | 0.95 |
| e1                          | -     | -    | 1.90 |
| E                           | 2.70  | 3.00 | 2.80 |
| E1                          | 1.50  | 1.70 | 1.60 |
| L                           | 0.35  | 0.55 | 0.40 |
| a                           | -     | -    | 8°   |
| a1                          | -     | -    | 7°   |
| <b>All Dimensions in mm</b> |       |      |      |

## Suggested Pad Layout

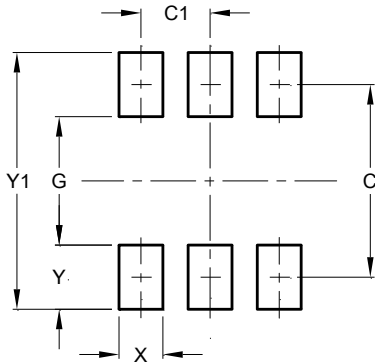
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### SOT25



| Dimensions | Value |
|------------|-------|
| Z          | 3.20  |
| G          | 1.60  |
| X          | 0.55  |
| Y          | 0.80  |
| C1         | 2.40  |
| C2         | 0.95  |

### SOT26



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 2.40          |
| C1         | 0.95          |
| G          | 1.60          |
| X          | 0.55          |
| Y          | 0.80          |
| Y1         | 3.20          |

**IMPORTANT NOTICE**

DIODES INCORPORATED MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

Diodes Incorporated and its subsidiaries reserve the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. Diodes Incorporated does not assume any liability arising out of the application or use of this document or any product described herein; neither does Diodes Incorporated convey any license under its patent or trademark rights, nor the rights of others. Any Customer or user of this document or products described herein in such applications shall assume all risks of such use and will agree to hold Diodes Incorporated and all the companies whose products are represented on Diodes Incorporated website, harmless against all damages.

Diodes Incorporated does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel. Should Customers purchase or use Diodes Incorporated products for any unintended or unauthorized application, Customers shall indemnify and hold Diodes Incorporated and its representatives harmless against all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized application.

Products described herein may be covered by one or more United States, international or foreign patents pending. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks.

This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes Incorporated.

**LIFE SUPPORT**

Diodes Incorporated products are specifically not authorized for use as critical components in life support devices or systems without the express written approval of the Chief Executive Officer of Diodes Incorporated. As used herein:

A. Life support devices or systems are devices or systems which:

1. are intended to implant into the body, or
2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.

Copyright © 2016, Diodes Incorporated

[www.diodes.com](http://www.diodes.com)