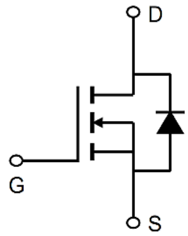
# AP3N04AI

## 40V N-Channel Enhancement Mode MOSFET

## Description

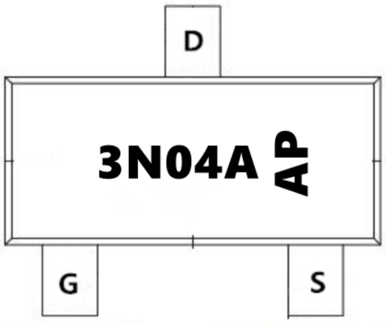
The AP3N04AI uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.




## General Features

$V_{DS}$ = 40V  $I_D$ =3A

$R_{DS(ON)}$ < 40mΩ @ $V_{GS}$=10V （Type：28mΩ）

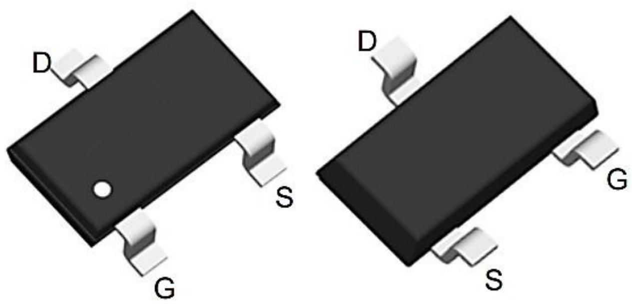



## Application

Wireless charging

Boost driver

LED




## Package Marking and Ordering Information

| Product ID | Pack | Marking | Qty(PCS) |
|---|---|---|---|
| AP3N04AI | SOT23L | 3N04A-AP | 3000 |

## Absolute Maximum Ratings ($T_C$=25℃unless otherwise noted)

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 40 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$@$T_A$=25˚C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 3 | A |
| $I_D$@$T_A$=70˚C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 2.9 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 15 | A |
| EAS | Single Pulse Avalanche Energy[3] | 16.2 | mJ |
| $P_D$@$T_A$=25˚C | Total Power Dissipation[4] | 1.67 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | ˚C |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | ˚C |
| $R_{θJA}$ | Thermal Resistance Junction-Ambient [1] | 125 | ˚C/W |
| $R_{θJC}$ | Thermal Resistance Junction-Case[1] | 30 | ˚C/W |

## N-Channel Electrical Characteristics ($T_J$=25 ℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| BVDSS | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250uA | 40 | 44 | --- | V |
| △BVDSS/△TJ | BVDSS Temperature Coefficient | Reference to 25℃ , $I_D$=1mA | --- | 0.032 | --- | V/℃ |
| RDS(ON) | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V , $I_D$=4A | --- | 28 | 40 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=3A | --- | 35 | 50 | |
| VGS(th) | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.0 | 1.5 | 2.5 | V |
| △$V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -4.5 | --- | mV/℃ |
| IDSS | Drain-Source Leakage Current | $V_{DS}$=32V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=32V , $V_{GS}$=0V , $T_J$=55℃ | --- | --- | 5 | |
| IGSS | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=5V , $I_D$=4A | --- | 8 | --- | S |
| $R_g$ | Gate Resistance | $V_{DS}$=0V , $V_{GS}$=0V , f=1MHz | --- | 2.4 | 4.8 | Ω |
| $Q_g$ | Total Gate Charge (4.5V) | $V_{DS}$=15V , $V_{GS}$=4.5V , $I_D$=3A | --- | 5 | --- | nC |
| Qgs | Gate-Source Charge | | --- | 1.54 | --- | |
| Qgd | Gate-Drain Charge | | --- | 1.84 | --- | |
| Td(on) | Turn-On Delay Time | $V_{DD}$=15V , $V_{GS}$=10V , $R_G$=3.3Ω $I_D$=1A | --- | 7.8 | --- | ns |
| $T_r$ | Rise Time | | --- | 2.1 | --- | |
| Td(off) | Turn-Off Delay Time | | --- | 29 | --- | |
| $T_f$ | Fall Time | | --- | 2.1 | --- | |
| Ciss | Input Capacitance | $V_{DS}$=15V , $V_{GS}$=0V , f=1MHz | --- | 452 | --- | pF |
| Coss | Output Capacitance | | --- | 51 | --- | |
| Crss | Reverse Transfer Capacitance | | --- | 38 | --- | |
| IS | Continuous Source Current[1,4] | $V_G$=$V_D$=0V , Force Current | --- | --- | 4.5 | A |
| ISM | Pulsed Source Current[2,4] | | --- | --- | 14 | A |
| VSD | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=1A , $T_J$=25℃ | --- | --- | 1.2 | V |

**Note :**

1、The data tested by surface mounted on a 1 inch$^2$ FR-4 board with 2OZ copper.

2、The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%

3、The power dissipation is limited by 150°C junction temperature

4、The data is theoretically the same as $I_D$ and $I_{DM}$ , in real applications , should be limited by total power dissipation.

## N-Typical Characteristics

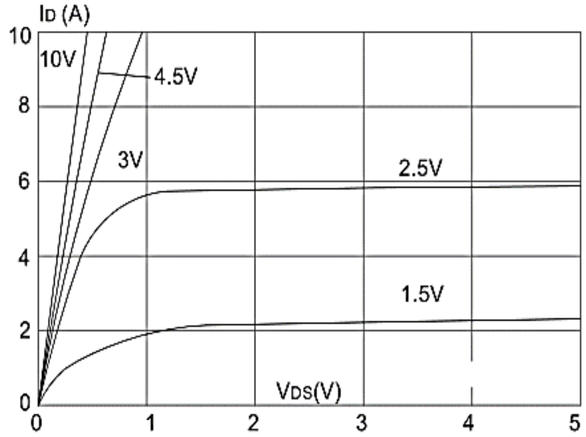



Figure1: Output Characteristics

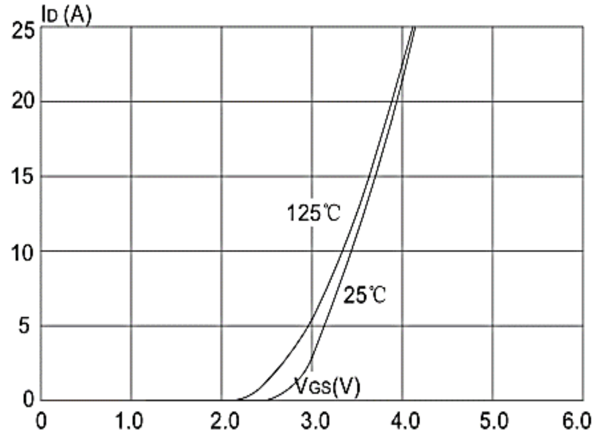



Figure 2: Typical Transfer Characteristics

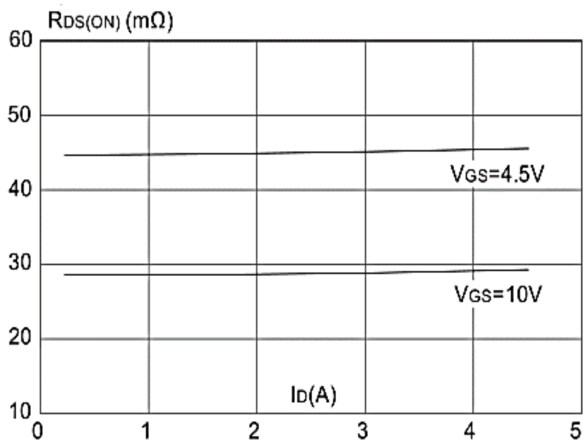



Figure 3:On-resistance vs. Drain Current

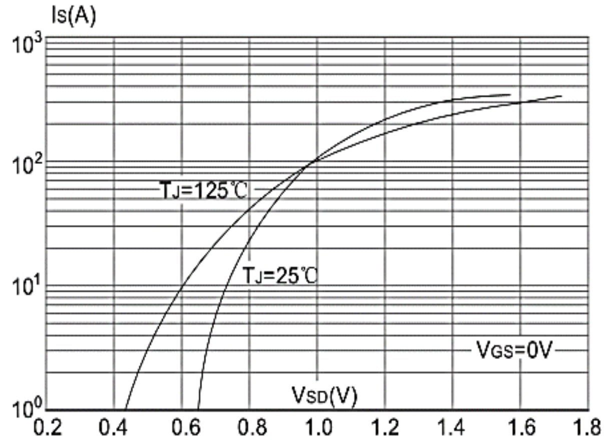



Figure 4: Body Diode Characteristics

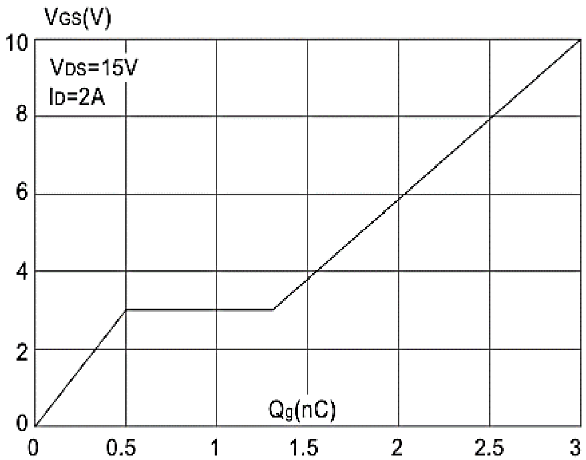



Figure 5: Gate Charge Characteristics

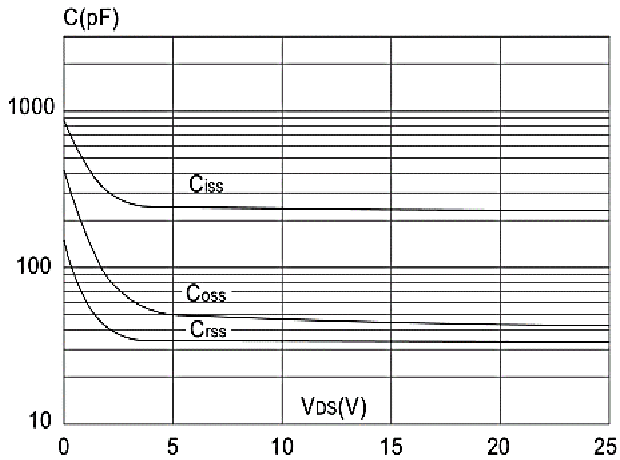



Figure 6: Capacitance Characteristics

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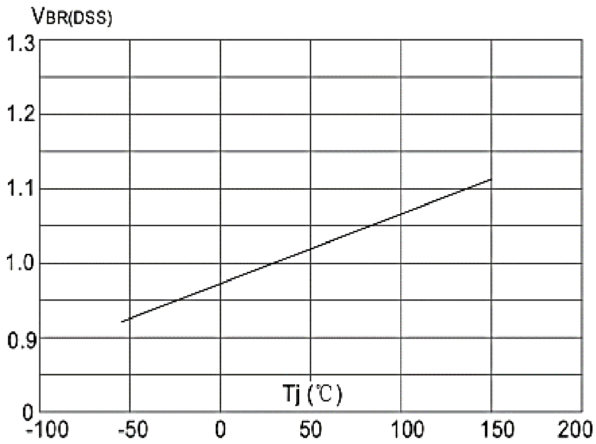



**Figure 7: Normalized Breakdown Voltage vs. Junction Temperature**

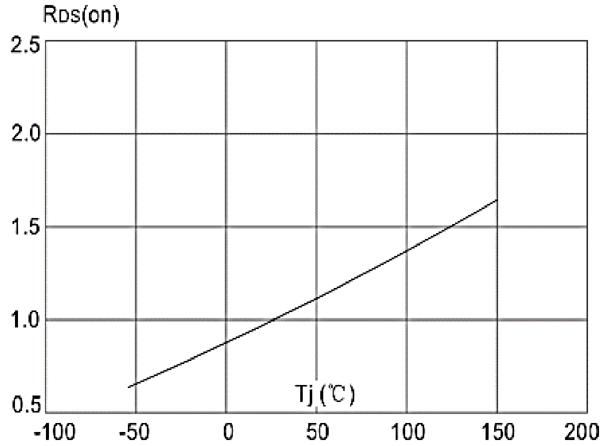



**Figure 8: Normalized on Resistance vs Junction Temperature**

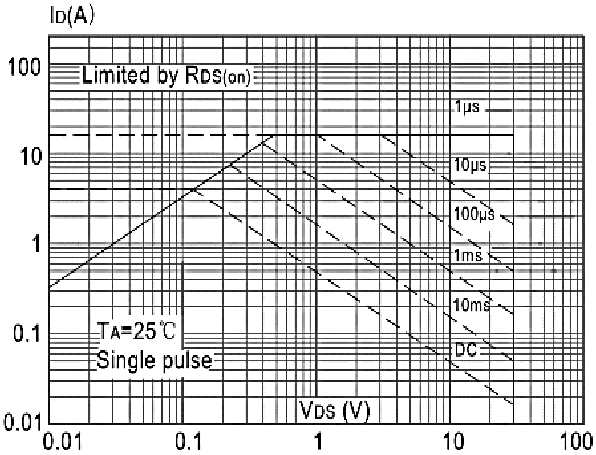



**Figure 9: Maximum Safe Operating Area vs. Case Temperature**

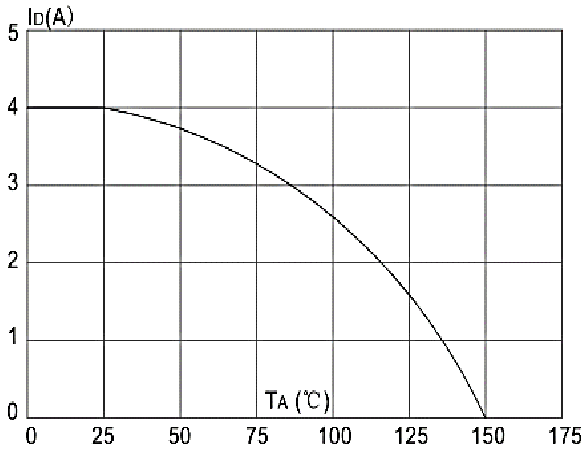



**Figure 10: Maximum Continuous Drain Current**

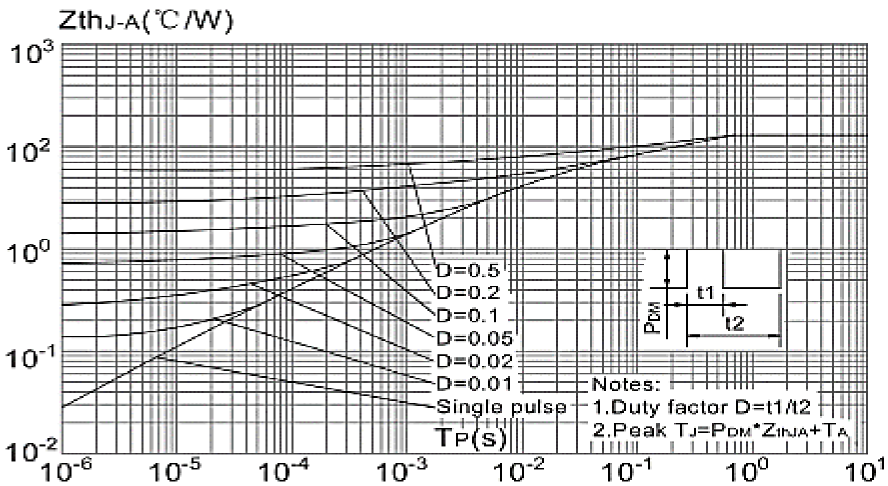
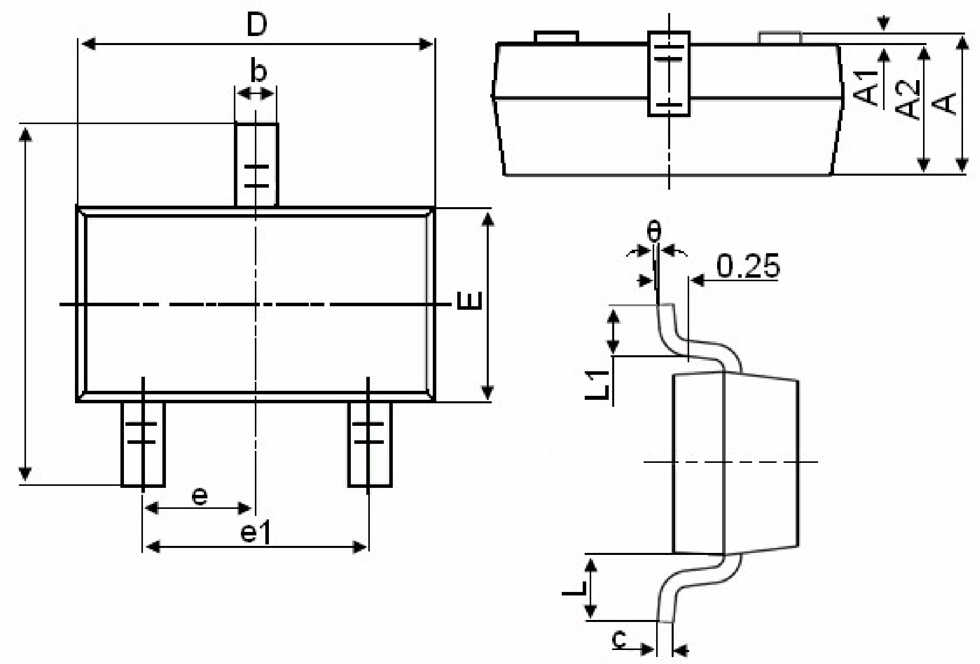



**Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case**

## Package Mechanical Data-SOT23-XC-Single




| Symbol | Dimensions in Millimeters | |
|---|---|---|
| | MIN. | MAX. |
| A | 0.900 | 1.150 |
| A1 | 0.000 | 0.100 |
| A2 | 0.900 | 1.050 |
| b | 0.300 | 0.500 |
| c | 0.080 | 0.150 |
| D | 2.800 | 3.000 |
| E | 1.200 | 1.400 |
| E1 | 2.250 | 2.550 |
| e | 0.950TYP | |
| e1 | 1.800 | 2.000 |
| L | 0.550REF | |
| L1 | 0.300 | 0.500 |
| θ | 0° | 8° |