

### Description

The AP1P02AK uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a Battery protection or in other Switching application.

### General Features

$V_{DS} = -20V$   $I_D = -1.8A$

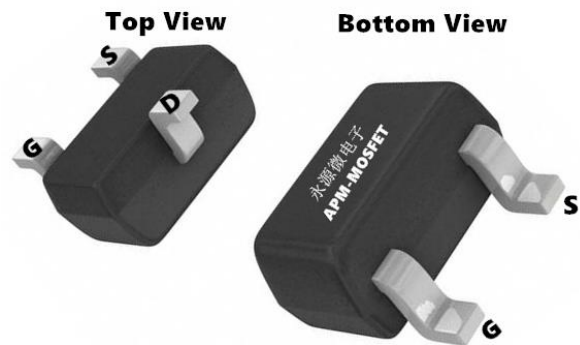
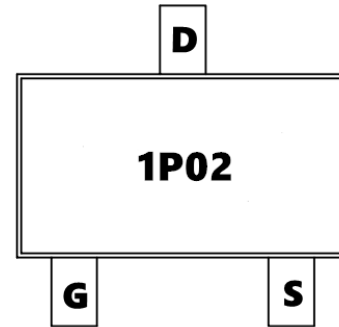
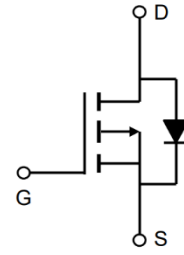
$R_{DS(ON)} < 125m\Omega$  @  $V_{GS} = -4.5V$  (Type: 95m $\Omega$ )

### Application

Battery protection

Load switch

Uninterruptible power supply



### Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
AP1P02AK	SOT523-3L	1P02AK	3000

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	-20	V
$V_{GS}$	Gate-Source Voltage	$\pm 12$	V
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V^1$	-1.8	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V^1$	-0.9	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	-8.4	A
$P_D @ T_A = 25^\circ C$	Total Power Dissipation <sup>3</sup>	0.9	W
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ C$
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	125	$^\circ C/W$
$R_{\theta JC}$	Thermal resistance, junction-case	28	$^\circ C/W$

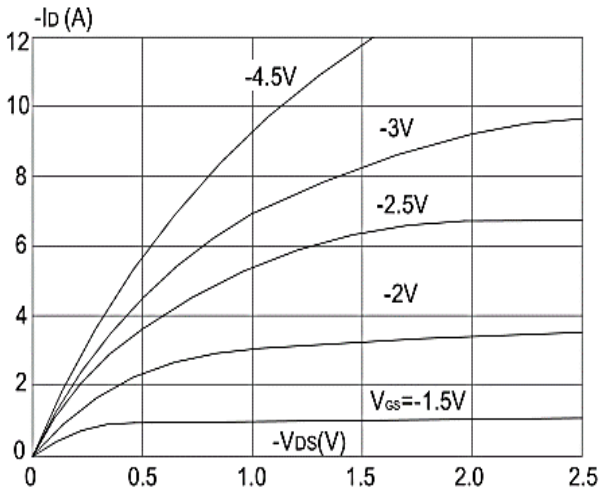
### Electrical Characteristics (T<sub>J</sub>=25°C, unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
V(BR)DSS	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> = -250μA	-20	-	-	V
IDSS	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V,	-	-	-1	μA
IGSS	Gate to Body Leakage Current	V <sub>DS</sub> =0V, V <sub>GS</sub> = ±12V	-	-	±100	nA
VGS(th)	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA	-0.4	-0.7	-1.0	V
RDS(on)	Static Drain-Source on-Resistance	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -2A	-	95	125	mΩ
		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -1A	-	135	190	
Ciss	Input Capacitance	V <sub>DS</sub> = -10V, V <sub>GS</sub> = 0V, f = 1.0MHz	-	185	-	pF
Coss	Output Capacitance		-	35	-	pF
Crss	Reverse Transfer Capacitance		-	25	-	pF
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = -10V, I <sub>D</sub> = -2A, V <sub>GS</sub> = -4.5V	-	2.2	-	nC
Q <sub>gs</sub>	Gate-Source Charge		-	0.5	-	nC
Q <sub>gd</sub>	Gate-Drain("Miller") Charge		-	0.5	-	nC
td(on)	Turn-on Delay Time	V <sub>DD</sub> = -10V, R <sub>L</sub> =5Ω, R <sub>GEN</sub> =3Ω, V <sub>GS</sub> =-4.5V,	-	10	-	ns
t <sub>r</sub>	Turn-on Rise Time		-	30	-	ns
td(off)	Turn-off Delay Time		-	63	-	ns
t <sub>f</sub>	Turn-off Fall Time		-	50	-	ns
IS	Maximum Continuous Drain to Source Diode Forward Current		-	-	-2.8	A
ISM	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-8	A
VSD	Drain to Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = -2A	-	-	-1.2	V

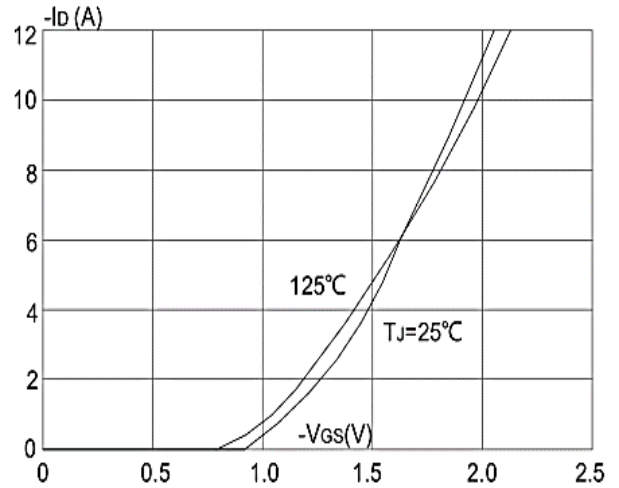
Note :

- 1、 The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
- 2、 The data tested by pulsed , pulse width Δ 300us , duty cycle Δ 2%
- 3、 The power dissipation is limited by 150°C junction temperature
- 4、 The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub> , in real applications , should be limited by total power dissipation.

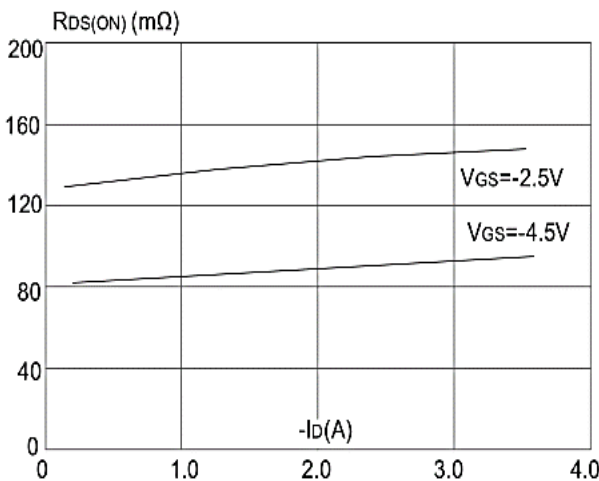
**Typical Characteristics**



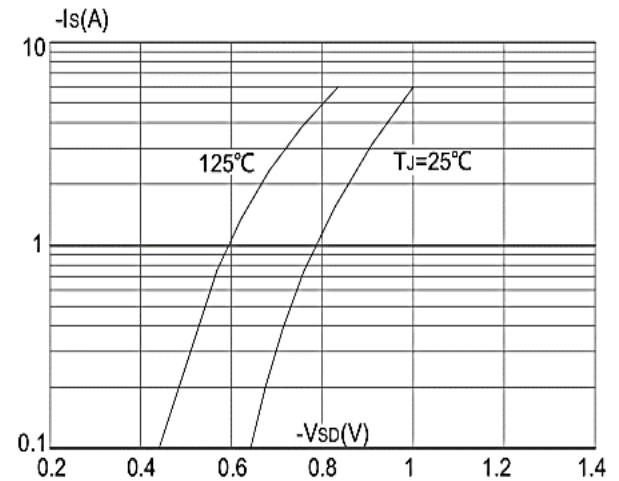
**Figure 1: Output Characteristics**



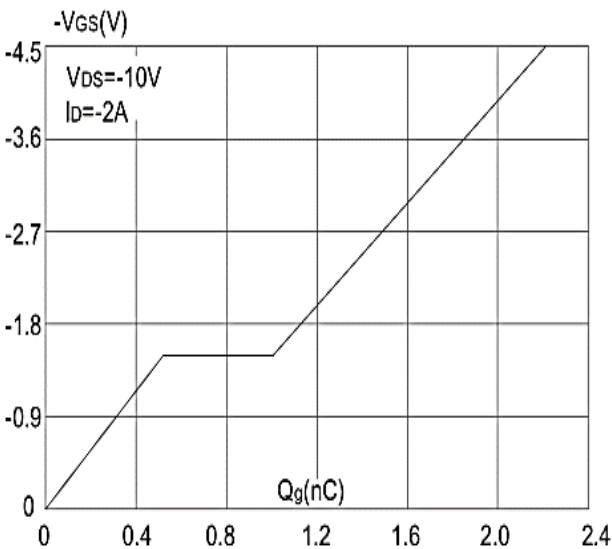
**Figure 2: Typical Transfer Characteristics**



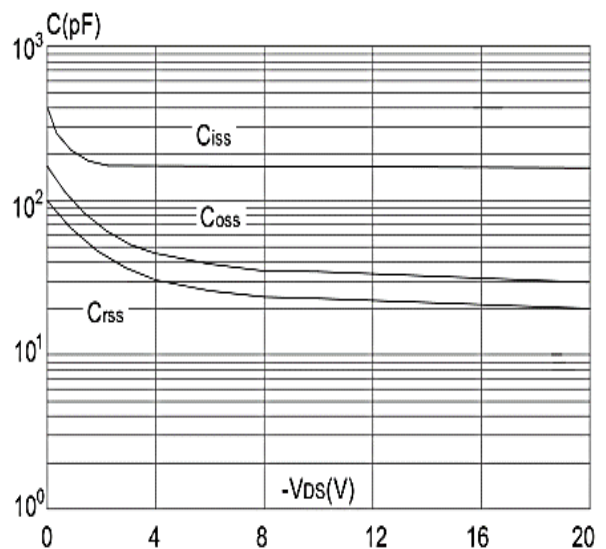
**Figure 3: On-resistance vs. Drain Current**



**Figure 4: Body Diode Characteristics**

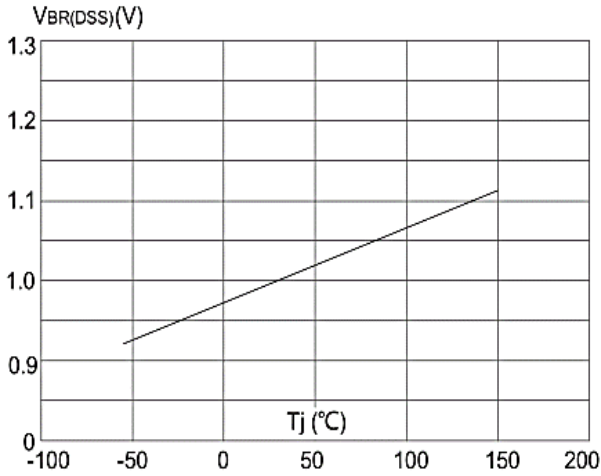


**Figure 5: Gate Charge Characteristics**

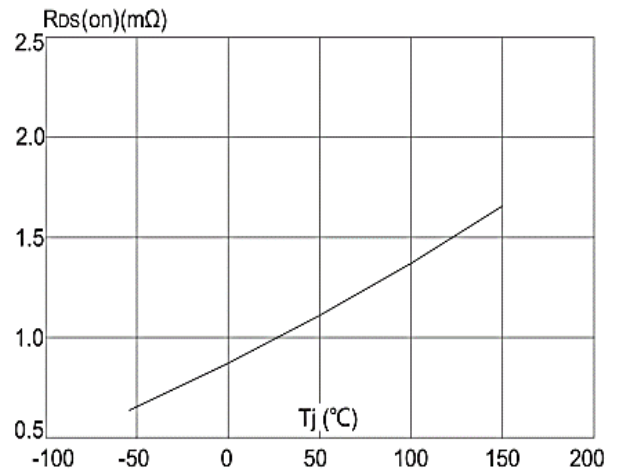


**Figure 6: Capacitance Characteristics**

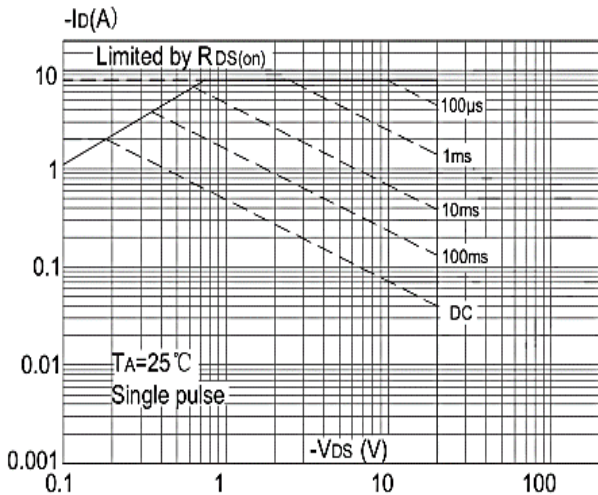




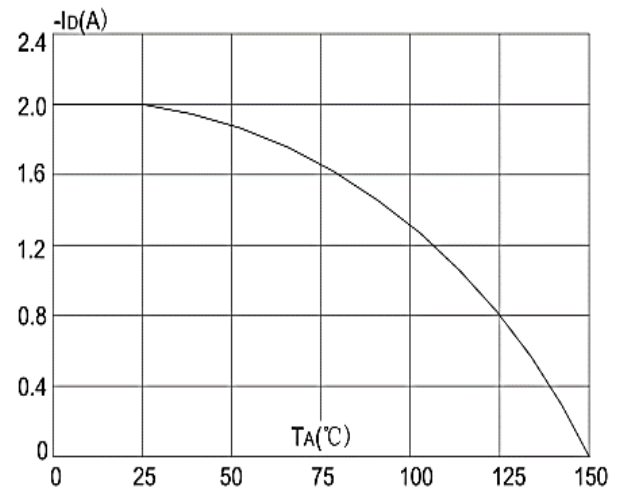
**Figure 7: Normalized Breakdown Voltage vs Junction Temperature**



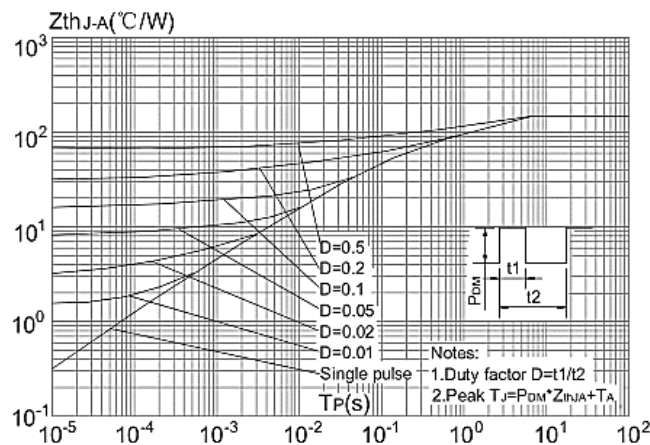
**Figure 8: Normalized on Resistance vs. Junction Temperature**



**Figure 9: Maximum Safe Operating Area**

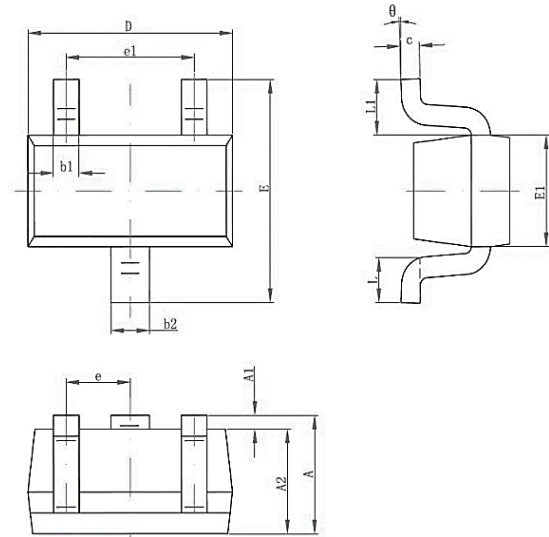


**Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature**



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

### Package Mechanical Data-SOT523-3-Single



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	0.70	0.90
A1	0.00	0.10
A2	0.70	0.80
b1	0.15	0.29
b2	0.25	0.39
C	0.10	0.20
D	1.50	1.70
E	1.45	1.75
E1	0.70	0.90
e	0.500 (Typ)	
e1	0.90	1.10
L	0.26	0.46
$\theta$	0°	8°

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Edition	Date	Change
REV1.0	2024/1/1	Initial release

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