# CHENMKO ENTERPRISE CO.,LTD

**2N7002N1PT**

## SURFACE MOUNT
## N-Channel Enhancement Mode Field Effect Transistor

*VOLTAGE 60 Volts CURRENT 0.250 Ampere*

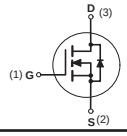
Lead free devices

### APPLICATION
* Servo motor control.
* Power MOSFET gate drivers.
* Other switching applications.

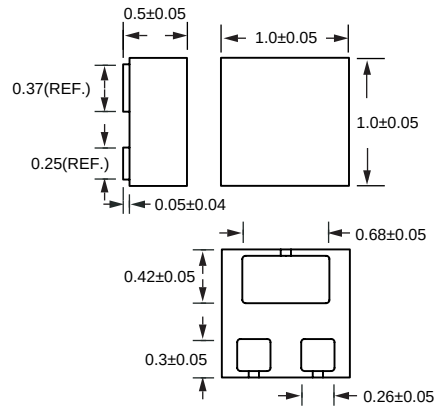
### FEATURE
* Small surface mounting type. (FBPT-923)
* High density cell design for low $R_{DS(ON)}$.
* Suitable for high packing density.
* Rugged and reliable.
* High saturation current capability.
* Voltage controlled small signal switch.

### CONSTRUCTION
* N-Channel Enhancement

### CIRCUIT




FBPT-923




Dimensions in millimeters

FBPT-923

## Absolute Maximum Ratings

$T_A$ = 25°C unless otherwise noted

| Symbol | Parameter | | 2N7002N1PT | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | | 60 | V |
| $V_{DGR}$ | Drain-Gate Voltage ($R_{GS}$ ≤ 1 MΩ) | | 60 | V |
| $V_{GSS}$ | Gate-Source Voltage - Continuous | | ±20 | V |
| | - Non Repetitive (tp < 50µs) | | ±40 | |
| $I_D$ | Maximum Drain Current - Continuous | $T_A$= 25°C | 250 | mA |
| | - Pulsed | $T_A$= 70°C | 190 | |
| $P_D$ | Maximum Power Dissipation | $T_A$= 25°C | 100 | mW |
| | | $T_A$= 70°C | 70 | mW |
| $T_J$,$T_{STG}$ | Operating and Storage Temperature Range | | -55 to 150 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering Purposes, 1/16" from Case for 10 Seconds | | 300 | °C |

## Thermal characteristics

| | | | |
|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 357 | °C/W |

2006-07

# RATING CHARACTERISTIC CURVES ( 2N7002N1PT )

## Electrical Characteristics $T_A$ = 25°C unless otherwise noted

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 10 µA | 60 | 70 | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 60 V, $V_{GS}$ = 0 V | | | 1 | µA |
| | | $T_C$=125°C | | | 0.5 | mA |
| $I_{GSSF}$ | Gate - Body Leakage, Forward | $V_{GS}$ = 15 V, $V_{DS}$ = 0 V | | | 10 | nA |
| $I_{GSSR}$ | Gate - Body Leakage, Reverse | $V_{GS}$ = -15 V, $V_{DS}$ = 0 V | | | -10 | nA |
| **ON CHARACTERISTICS** (Note 1) | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 1 | 2.0 | 2.5 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = 10 V, $I_D$ = 250 mA | | 1.7 | 3.0 | Ω |
| | | $V_{GS}$ = 4.0 V, $I_D$ = 100 mA | | 2.5 | 4.0 | |
| $V_{DS(ON)}$ | Drain-Source On-Voltage | $V_{GS}$ = 10 V, $I_D$ = 500mA | | 0.6 | 3.75 | V |
| | | $V_{GS}$ = 5.0 V, $I_D$ = 50 mA | | 0.09 | 1.5 | |
| $I_{D(ON)}$ | On-State Drain Current | $V_{GS}$ = 10 V, $V_{DS}$ = 7.5$V_{DS(on)}$ | 800 | 1800 | | mA |
| | | $V_{GS}$ = 4.5V, $V_{DS}$ = 10$V_{DS(on)}$ | 500 | 700 | | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 15 $V_{DS(on)}$, $I_D$ = 200 mA | | 250 | | mS |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 30 V, $V_{GS}$ = 10 V, $I_D$= 250 mA | | 0.6 | 1.0 | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 0.06 | 25 | |
| $Q_{gd}$ | Gate-Drain Charge | | | 0.06 | 5 | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1.0 MHz | | 25 | 50 | pF |
| $C_{oss}$ | Output Capacitance | | | 6 | 25 | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 1.2 | 5 | |
| $t_{on}$ | Turn-On Time | $V_{DD}$ = 30 V, $R_L$ = 200 Ω, $I_D$ = 100 mA, $V_{GS}$ = 10 V, $R_{GEN}$ = 10 Ω | | 7.5 | 20 | nS |
| $t_r$ | | | | 6 | | |
| $t_{off}$ | Turn-Off Time | $V_{DD}$ = 30 V, $R_L$ = 200 Ω, $I_D$ = 100 mA, $V_{GS}$ = 10 V, $R_{GEN}$ = 10 Ω | | 7.5 | 20 | nS |
| $t_f$ | | | | 3 | | |
| **DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS** | | | | | | |
| $I_S$ | Maximum Continuous Drain-Source Diode Forward Current | | | | 115 | mA |
| $I_{SM}$ | Maximum Pulsed Drain-Source Diode Forward Current | | | | 0.8 | A |
| $V_{SD}$ | Drain-Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = 200 mA (Note 1) | | 0.85 | 1.2 | V |

Note:
1. Pulse Test: Pulse Width < 300µs, Duty Cycle < 2.0%.

# RATING CHARACTERISTIC CURVES ( 2N7002N1PT )

## Typical Electrical Characteristics

**Figure 1. On-Region Characteristics**

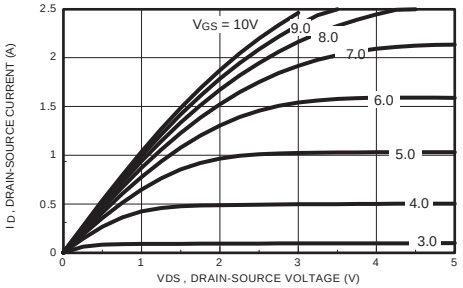



**Figure 2. On-Resistance Variation with Gate Voltage and Drain Current**

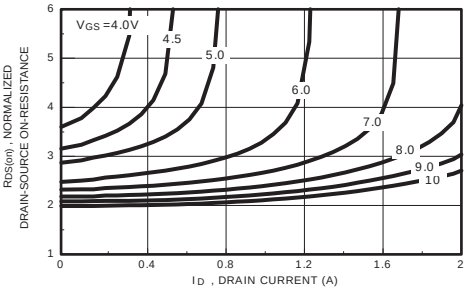



**Figure 3. On-Resistance Variation with Temperature**

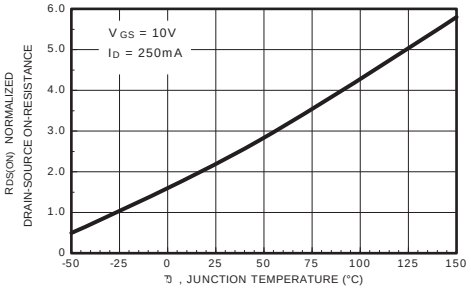



**Figure 4. On-Resistance Variation with Drain Current and Temperature**

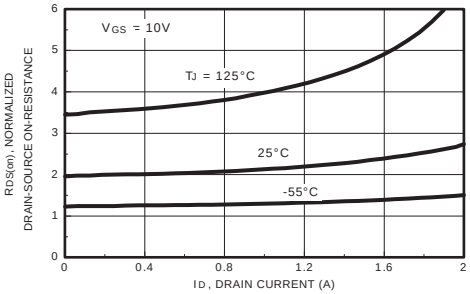



**Figure 5. Transfer Characteristics**

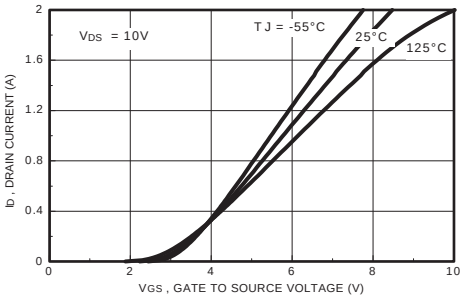
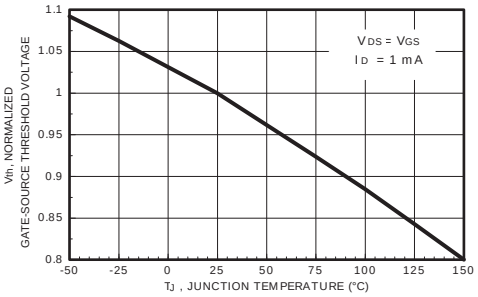



**Figure 6. Gate Threshold Variation with Temperature**



# RATING CHARACTERISTIC CURVES ( 2N7002N1PT )

## Typical Electrical Characteristics (continued)

**Figure 7. Breakdown Voltage Variation with Temperature**

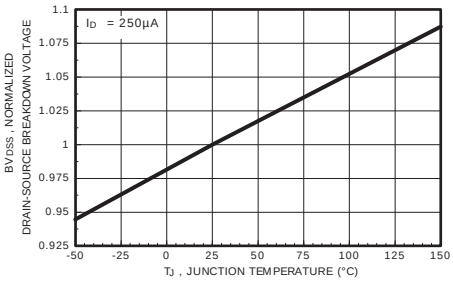



**Figure 8. Body Diode Forward Voltage Variation with Drain Current**

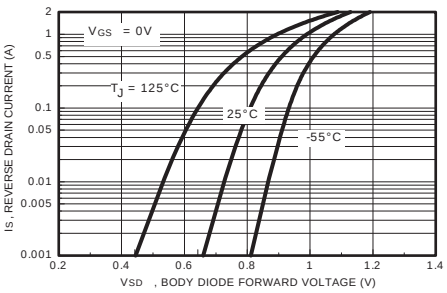



**Figure 9. Capacitance Characteristics**

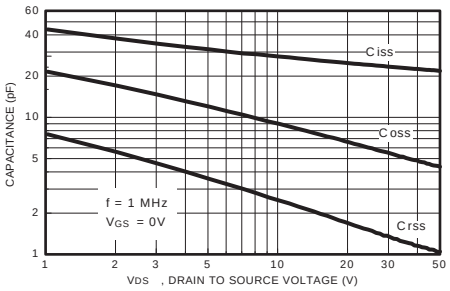



**Figure 10. Gate Charge Characteristics**

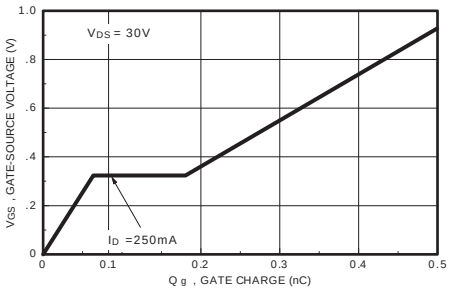



**Figure 11.**

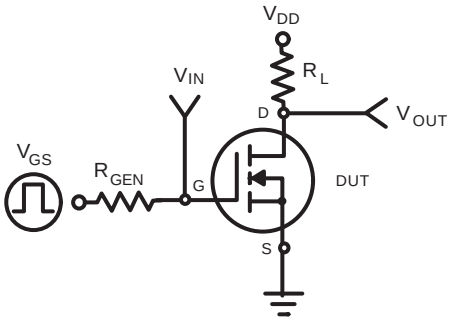



**Figure 12. Switching Waveforms**

