

## Features

- Low On-resistance And Low Gate Charge
- Super Junction technology for High Voltage Application
- Epoxy Meets UL 94 V-0 Flammability Rating
- Halogen Free."Green "Device<sup>(Note 1)</sup>
- Lead Free Finish/RoHS Compliant. "P" Suffix Designates RoHS Compliant. See Ordering Information

## Maximum Ratings

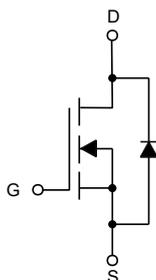
- Operating Junction Temperature Range : -55°C to +150°C
- Storage Temperature Range: -55°C to +150°C
- Thermal Resistance Junction to Ambient,Max<sup>(Note 2)</sup>: 60°C/W
- Thermal Resistance Junction to Case,Max : 2.67°C/W

| Parameter                                       | Symbol   | Value                   | Unit |
|---|----------|-------------------------|------|
| Drain-Source Voltage                            | $V_{DS}$ | 950                     | V    |
| Gate-Source Voltage                             | $V_{GS}$ | ±30                     | V    |
| Continuous Drain Current                        | $I_D$    | $T_C=25^\circ\text{C}$  | 3.4  |
|   |          | $T_C=100^\circ\text{C}$ | 2.2  |
| Pulsed Drain Current <sup>(Note 3)</sup>        | $I_{DM}$ | 13.6                    | A    |
| Total Power Dissipation, $T_C=25^\circ\text{C}$ | $P_D$    | 46.8                    | W    |
| Single Avalanche Energy <sup>(Note 4)</sup>     | $E_{AS}$ | 158                     | mJ   |

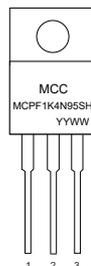
Note:

1. Halogen free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
2. Device in a still air environment with  $T_A=25^\circ\text{C}$ .
3. Repetitive rating; pulse width limited by max. junction temperature.
4. Starting  $T_J=25^\circ\text{C}$ ,  $V_{DD}=100\text{V}$ ,  $I_D=2.0\text{A}$ .

## Internal Structure and Marking Code



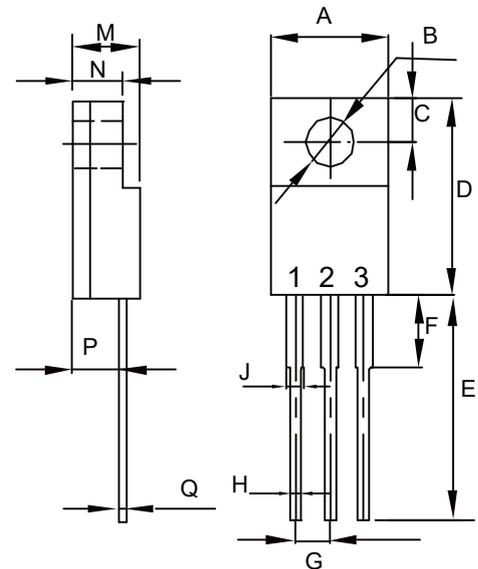
1. Gate
2. Drain
3. Source



YYWW: 4 codes in total  
YY is the year  
WW is the week

# N-CHANNEL Super-Junction Power MOSFET

## TO-220F



| DIM | INCHES |       | MM    |       | NOTE |
|-----|--------|-------|-------|-------|------|
|     | MIN    | MAX   | MIN   | MAX   |      |
| A   | 0.392  | 0.421 | 9.96  | 10.70 |      |
| B   | 0.138  |       | 3.50  |       | Φ    |
| C   | 0.106  |       | 2.70  |       | TYP. |
| D   | 0.567  | 0.642 | 14.40 | 16.30 |      |
| E   | 0.520  |       | 13.20 |       | TYP. |
| F   | ---    | 0.177 | ---   | 4.50  |      |
| G   | 0.100  |       | 2.54  |       | TYP. |
| H   | 0.020  | 0.035 | 0.50  | 0.90  |      |
| J   | 0.043  | 0.053 | 1.10  | 1.35  |      |
| M   | 0.169  | 0.201 | 4.30  | 5.10  |      |
| N   | ---    | 0.140 | ---   | 3.56  |      |
| P   | 0.083  | 0.126 | 2.10  | 3.20  |      |
| Q   | 0.020  | 0.032 | 0.50  | 0.80  |      |

**Electrical Characteristics** ( $T_J = 25^\circ\text{C}$  unless otherwise specified)

| Parameter                       | Symbol        | Test Conditions                                  | Min | Typ  | Max       | Unit     |
|---------------------------------|---------------|--|-----|------|-----------|----------|
| <b>Static Characteristics</b>   |               |  |     |      |           |          |
| Drain-Source Breakdown Voltage  | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=250\mu A$                        | 950 |      |           | V        |
| Gate-Source Leakage Current     | $I_{GSS}$     | $V_{DS}=0V, V_{GS}=\pm 30V$                      |     |      | $\pm 100$ | nA       |
| Zero Gate Voltage Drain Current | $I_{DSS}$     | $V_{DS}=950V, V_{GS}=0V$                         |     |      | 1         | $\mu A$  |
| Gate-Threshold Voltage          | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=250\mu A$                    | 2   | 3.4  | 4         | V        |
| Drain-Source On-Resistance      | $R_{DS(on)}$  | $V_{GS}=10V, I_D=2.5A$                           |     | 1.1  | 1.49      | $\Omega$ |
| Gate Resistance                 | $R_g$         | f=1 MHz, Open drain                              |     | 3    |           | $\Omega$ |
| <b>Diode Characteristics</b>    |               |  |     |      |           |          |
| Continuous Body Diode Current   | $I_S$         |  |     |      | 3.4       | A        |
| Body Diode Voltage              | $V_{SD}$      | $I_S=5A, V_{GS}=0V$                              |     |      | 1.4       | V        |
| Reverse Recovery Time           | $t_{rr}$      | $V_R=100V, I_F=5A, di/dt=634A/\mu s$             |     | 160  |           | ns       |
| Reverse Recovery Charge         | $Q_{rr}$      |  |     | 2334 |           | nC       |
| Peak Reverse Recovery Current   | $I_{rrm}$     |  |     | 27   |           | A        |
| <b>Dynamic Characteristics</b>  |               |  |     |      |           |          |
| Input Capacitance               | $C_{iss}$     | $V_{DS}=100V, V_{GS}=0V, f=1MHz$                 |     | 469  |           | pF       |
| Output Capacitance              | $C_{oss}$     |  |     | 18   |           |          |
| Reverse Transfer Capacitance    | $C_{rss}$     |  |     | 1.0  |           |          |
| Total Gate Charge               | $Q_g$         | $V_{DS}=720V, I_D=5A, V_{GS}=10V$                |     | 16   |           | nC       |
| Gate-Source Charge              | $Q_{gs}$      |  |     | 2.5  |           |          |
| Gate-Drain Charge               | $Q_{gd}$      |  |     | 9.0  |           |          |
| Turn-On Delay Time              | $t_{d(on)}$   | $V_{DD}=450V, V_{GS}=10V, I_D=5A, R_G=2.2\Omega$ |     | 22   |           | ns       |
| Turn-On Rise Time               | $t_r$         |  |     | 15   |           |          |
| Turn-Off Delay Time             | $t_{d(off)}$  |  |     | 19   |           |          |
| Turn-Off Fall Time              | $t_f$         |  |     | 26   |           |          |

**Typical Characteristics** ( $T_J=25^\circ\text{C}$  unless otherwise specified)

Fig. 1 - Typical Output Characteristics

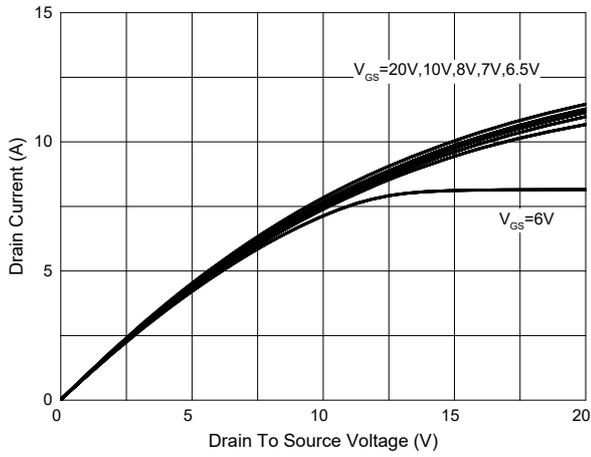


Fig. 2 - Transfer Characteristic

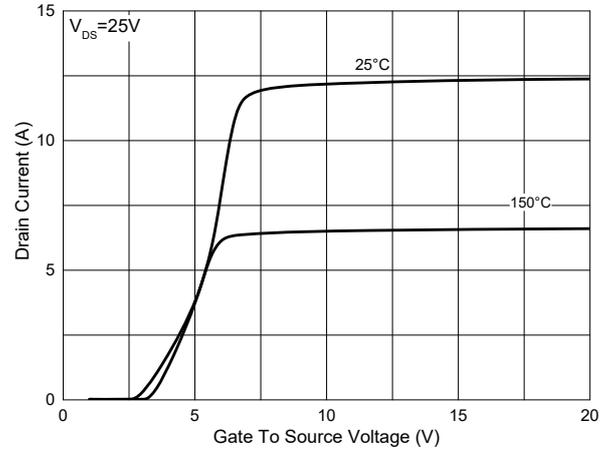


Fig. 3 -  $R_{DS(ON)} - V_{GS}$

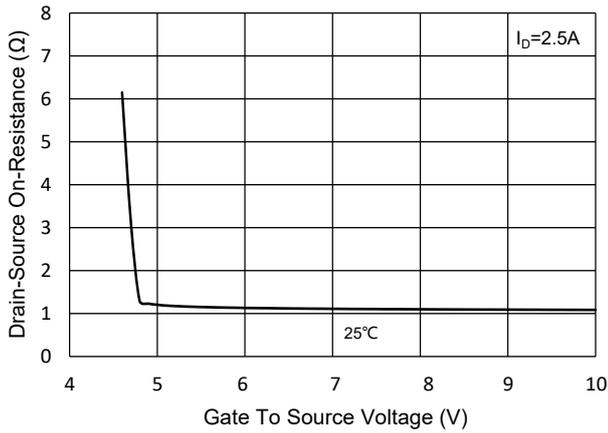


Fig. 4 -  $R_{DS(ON)} - I_D$

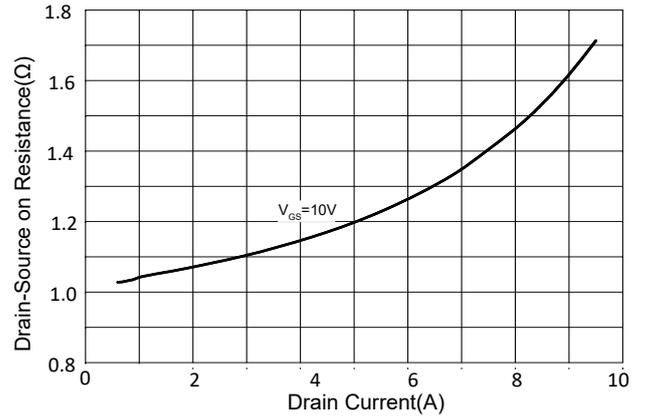


Fig. 5 - Capacitance Characteristics

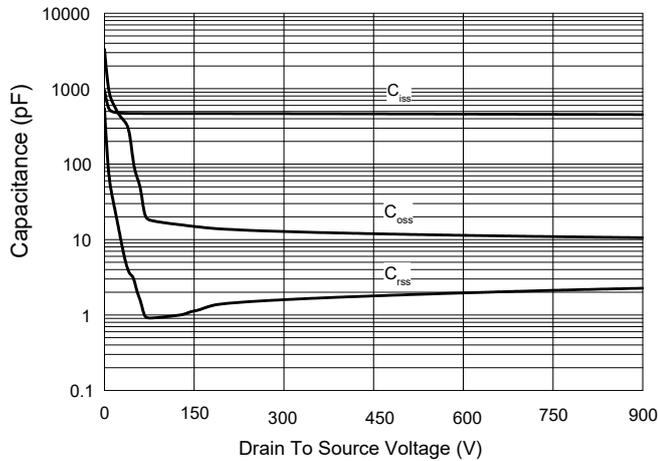
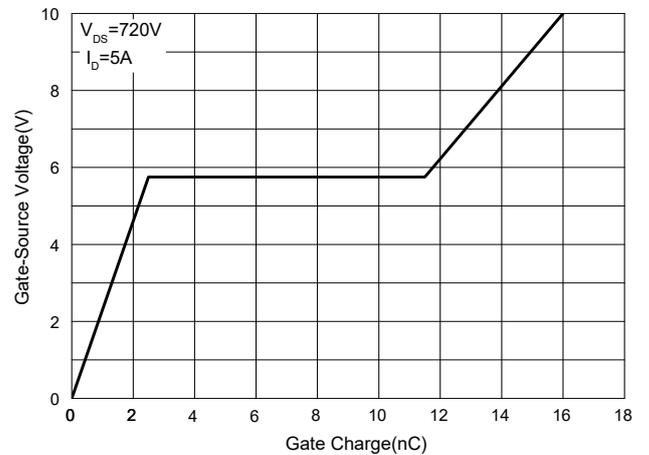


Fig. 6 - Gate Charge



Typical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise specified)

Fig.7 - Normalized Threshold Voltage

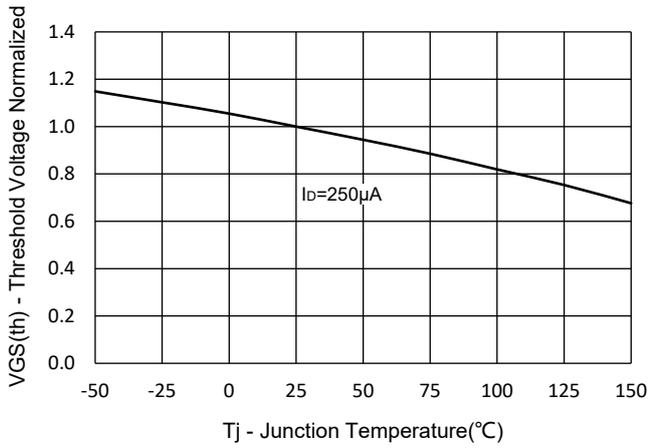


Fig.8 - Normalized On Resistance Characteristics

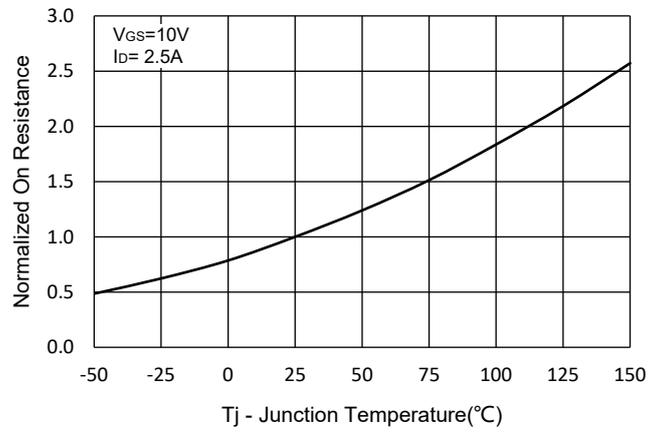


Fig.9 -  $I_s - V_{SD}$

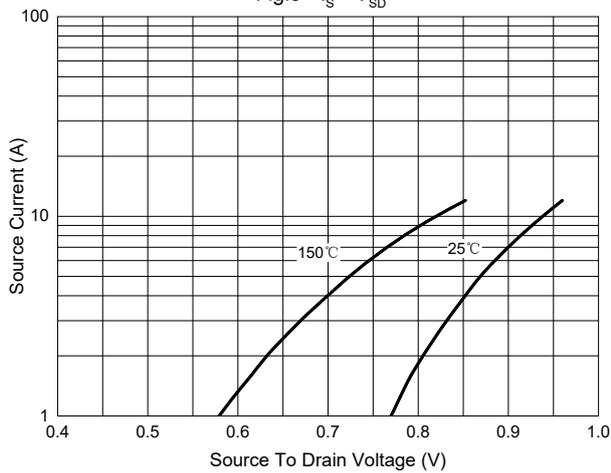


Fig.10 - Drain Current

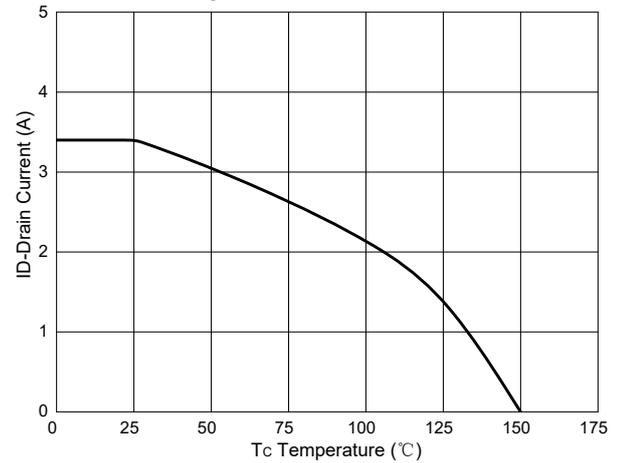
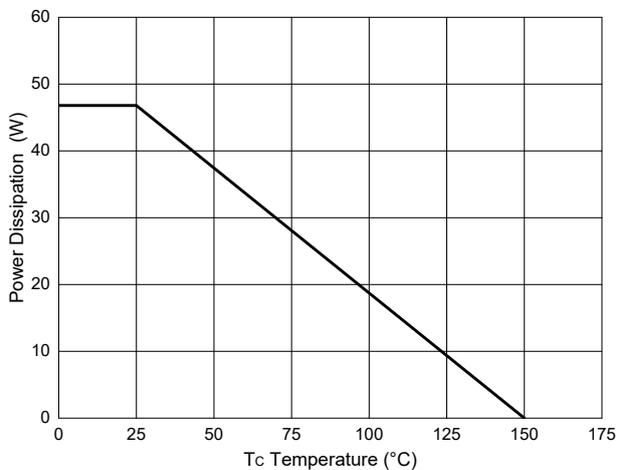


Fig.11 - PD Dissipation



Typical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise specified)

Fig. 12 - Safe Operation Area

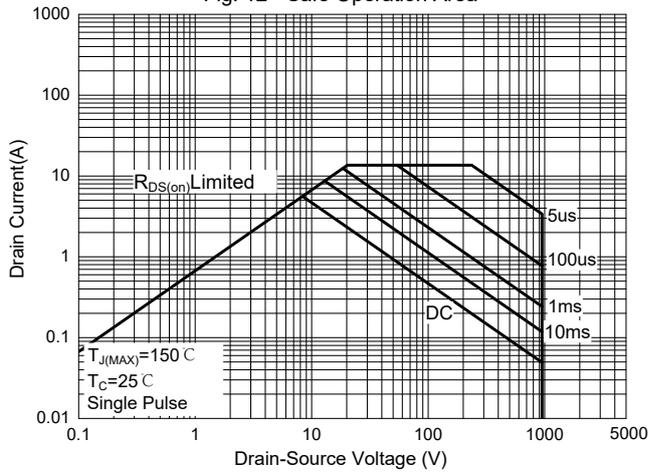
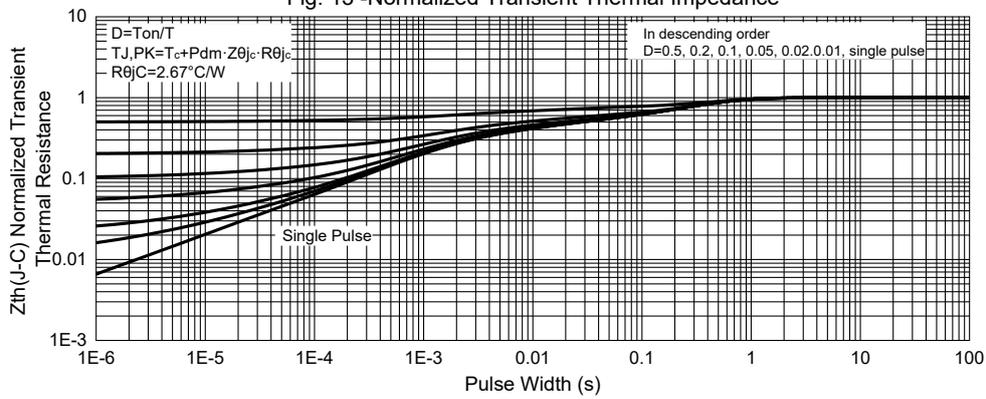


Fig. 13 - Normalized Transient Thermal Impedance



## Ordering Information

| Device         | Packing                                |
|----------------|--|
| Part Number-BP | Bulk: 50pcs/Tube; 1Kpcs/Box; 5Kpcs/Ctn |

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