# PRM028N04E

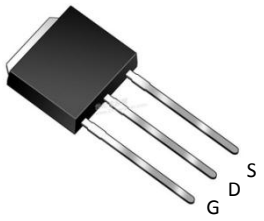
PFC Device Corporation

## 40V Single N-Channel MOSFET

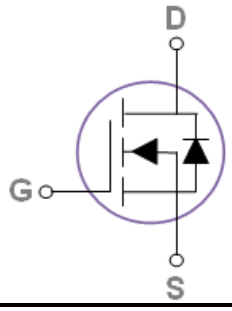
### Major ratings and characteristics

| Characteristics | Values | Units |
|---|---|---|
| $V_{DS}$ | 40 | **V** |
| $I_D$[6] ($T_C$=25˚C) | 14 | **A** |
| Max. $R_{DS(ON)}$@$V_{GS}$=10V | 28 | **mΩ** |
| Max. $R_{DS(ON)}$@$V_{GS}$=4.5V | 38 | **mΩ** |
| $T_J$ Operating Junction Temperature | -55 to +150 | **ºC** |

**PRM028N04E**




**TO-251**




### General Description

The N-Channel enhancement mode power field effect transistor is using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. The device is well suited for high efficiency fast switching applications.

### Typical Applications

- Charger Adapter
- Power Tools
- LED Lighting

### Features

- Max. $R_{DS(ON)}$=28mΩ@$V_{GS}$=10V
- Improved dv/dt capability
- Fast switching
- 100% $E_{AS}$ Guaranteed
- Green Device Available

## 1. Characteristics

**Maximum Ratings Characteristics** ( $T_A$ = 25 °C unless otherwise specified )

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 40 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$[5] | Drain Current – Continuous ($T_C$=25°C) | 23.6 | A |
| | Drain Current – Continuous ($T_C$=100°C) | 14.9 | A |
| $I_D$[6] | Drain Current – Continuous ($T_C$=25°C) | 14 | A |
| $I_{DM}$ | Drain Current – Pulsed[1] | 40 | A |
| $E_{AS}$ | Single Pulse Avalanche Energy[2] | 5 | mJ |
| $I_{AS}$ | Single Pulse Avalanche Current[2] | 10 | A |
| $P_D$ | Power Dissipation ($T_C$=25°C) | 31.2 | W |
| | Power Dissipation – Derate above 25°C | 0.25 | W/°C |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | °C |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | °C |

**Thermal Characteristics**

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | --- | 62 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case | --- | 4 | °C/W |

## Electrical Characteristics ( $T_J$ = 25 °C unless otherwise specified )

### Off Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_D$=250uA | 40 | --- | --- | V |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=40V, $V_{GS}$=0V, $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=40V, $V_{GS}$=0V, $T_J$=125℃ | --- | --- | 250 | uA |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V, $V_{DS}$=0V | --- | --- | ±100 | nA |

### On Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=11A | --- | --- | 28 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=5A | --- | --- | 38 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$, $I_D$=250uA | 1.0 | --- | 3.0 | V |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=5V, $I_D$=11A | --- | 17 | --- | S |

### Dynamic and switching Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge[3,4] | $V_{DS}$=20V, $V_{GS}$=10V, $I_D$=20A | --- | 10 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge[3,4] | | --- | 2.2 | --- | |
| $Q_{gd}$ | Gate-Drain Charge[3,4] | | --- | 2.5 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time[3,4] | $V_{DD}$=20V, $V_{GS}$=10V, $R_G$=6Ω $I_D$=20A | --- | 7 | --- | ns |
| $T_r$ | Turn-On Rise Time[3,4] | | --- | 18 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time[3,4] | | --- | 13 | --- | |
| $T_f$ | Turn-Off Fall Time[3,4] | | --- | 3 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=25V, $V_{GS}$=0V, f=1MHz | --- | 530 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 50 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 35 | --- | |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | --- | 1.5 | --- | Ω |

### Drain-Source Diode Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Source to Drain Diode Voltage | $V_{GS}$=0V, $I_S$=20A | --- | --- | 1.5 | V |

Note :

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. $V_{DD}$=50V, $V_{GS}$=10V, L=0.1mH, $I_{AS}$=10A, $R_G$=25Ω, Starting $T_J$=25℃
3. The data tested by pulsed , pulse width ≦300us , duty cycle ≦2%.
4. Essentially independent of operating temperature.
5. Silicon limited.
6. Package limited.

## 2. Characteristics Curves

**Ratings and Characteristics Curves** **( $T_A$ = 25℃ unless otherwise specified )**

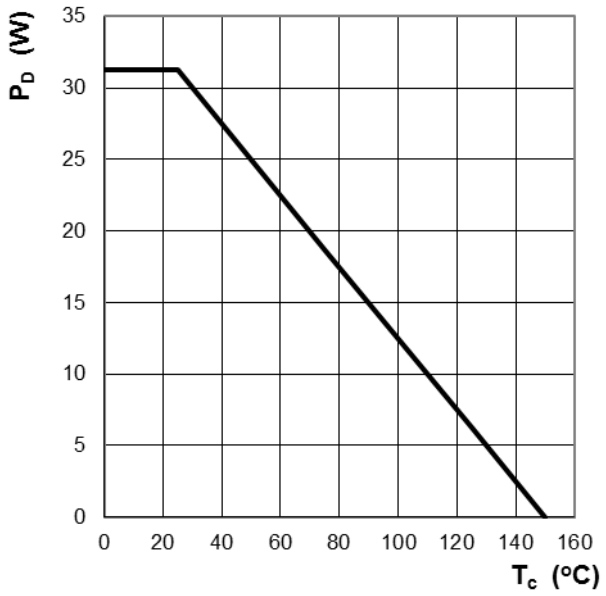



**Figure 1: Power Dissipation**

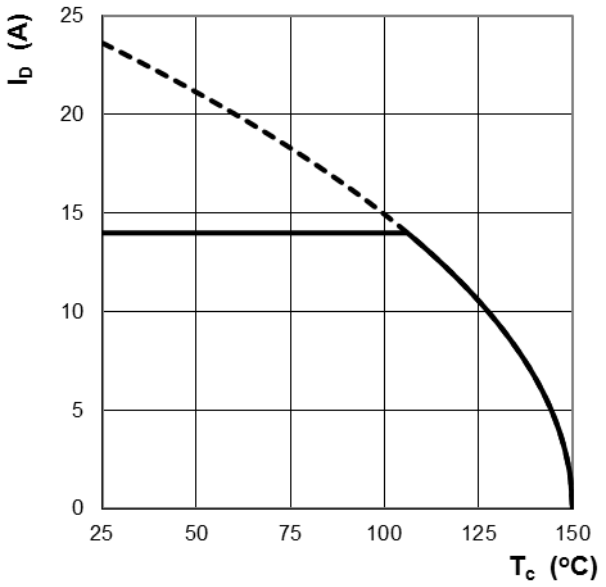



**Figure 2: Continuous Drain Current vs. $T_C$**

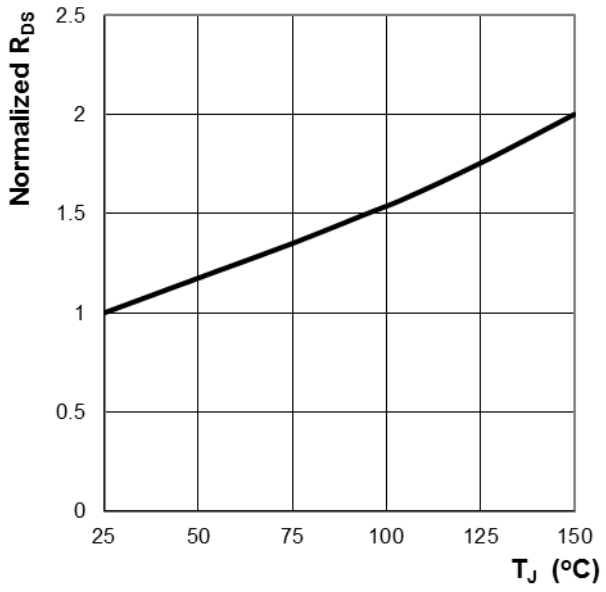



**Figure 3: Normalized $R_{DS(ON)}$ vs. $T_J$**

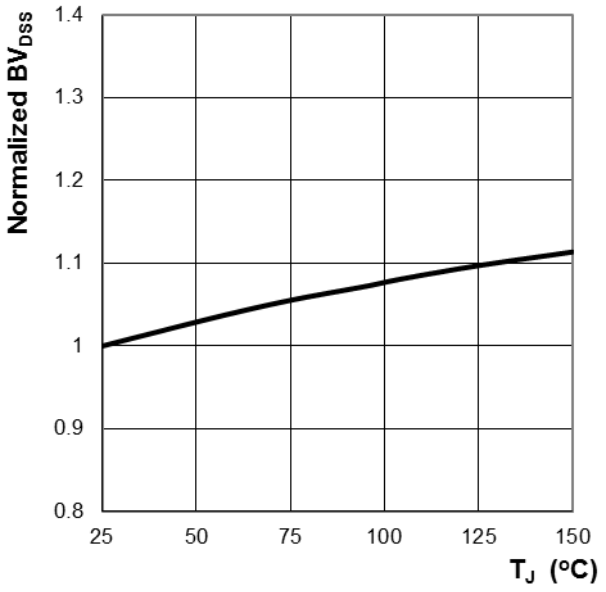



**Figure 4: Normalized $BV_{DSS}$ vs. $T_J$**

**Ratings and Characteristics Curves** **( $T_A$ = 25℃ unless otherwise specified )**

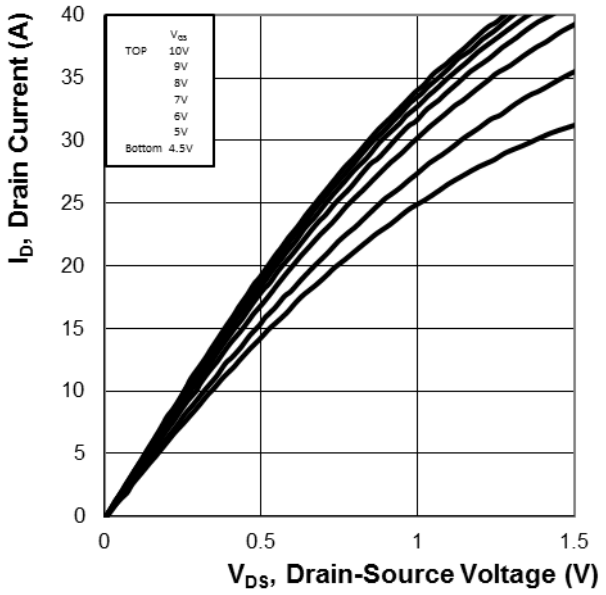



**Figure 5: On-Region Characteristics**

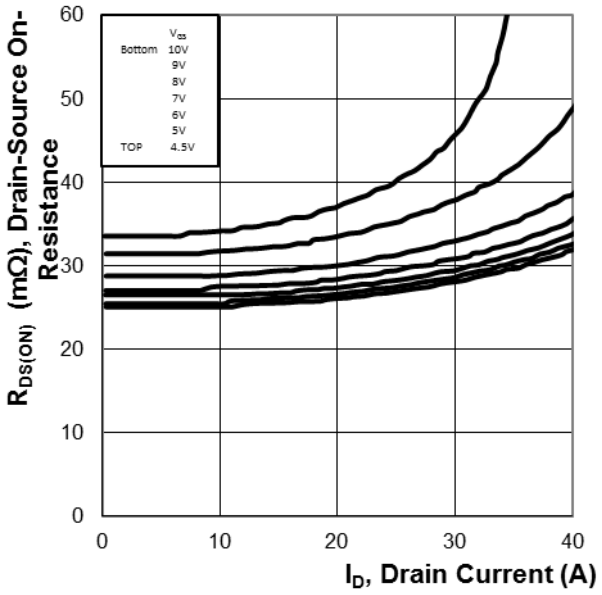



**Figure 6: Typ. $R_{DS}$ Variation vs. $I_D$ and $V_{GS}$**

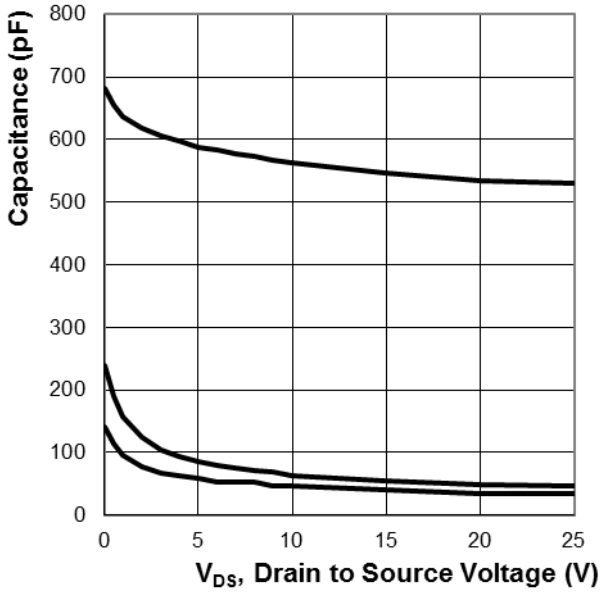



**Figure 7: Typ. Capacitance Characteristics**

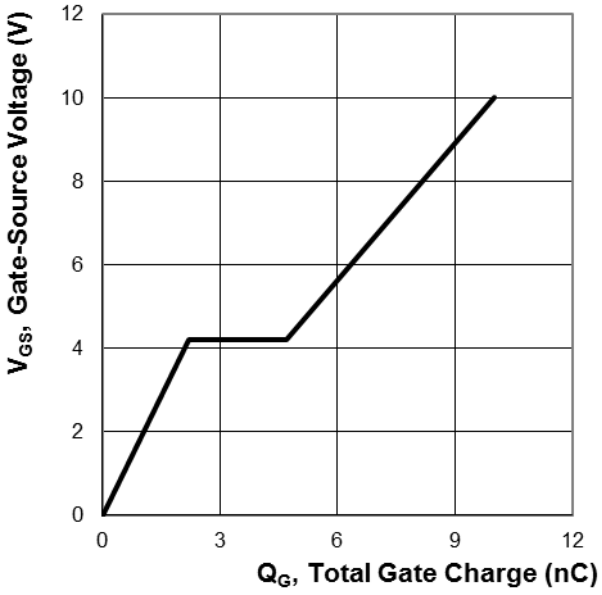



**Figure 8: Typ. Gate Charge Characteristics**

**Ratings and Characteristics Curves** **( $T_A$ = 25℃ unless otherwise specified )**

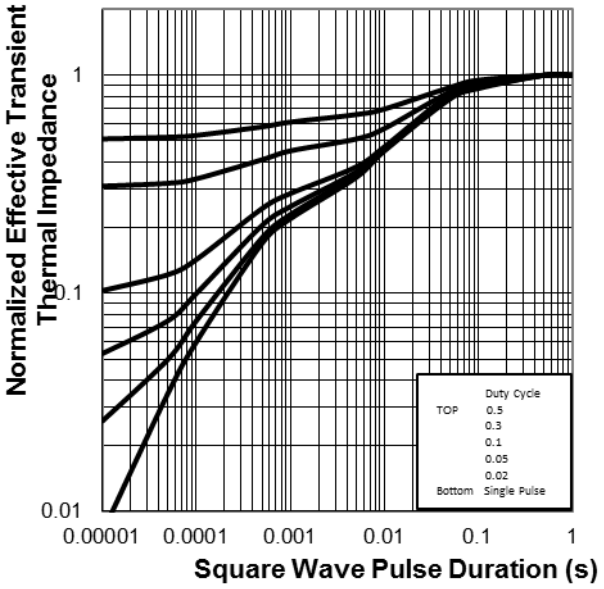



**Figure 9: Normalized Thermal Transient Impedance, Junction-to-Case**

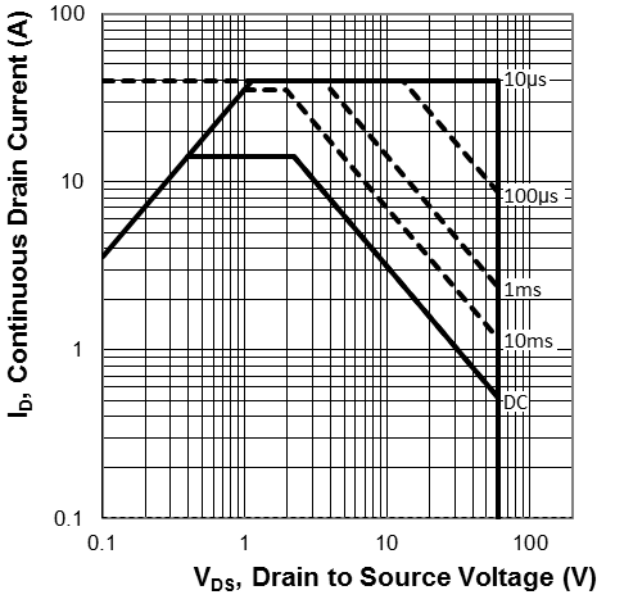



**Figure 10: Maximum Safe Operation Area**

## 3. Marking information

**Top Marking Rule**

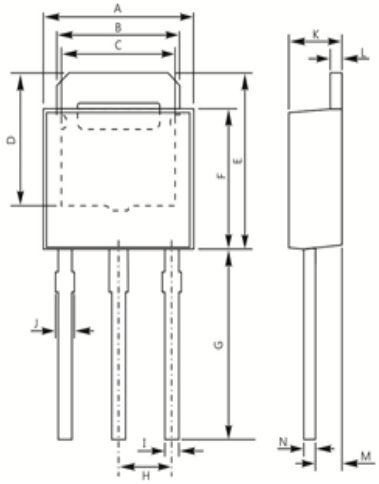
| PFC PRM |
|---|
| 028N04E |
| YYWW ABSH |

PRM028N04E = Product Type Marking Code
YYWW = Date Code
YY = Last two digits of year
WW = Week code
ABS = Assembly code
H = Halogen Free (N/A = common molding compound)

## 4. Package information

**Package Outline Dimensions millimeters**

**TO-251 ( IPAK )**




| Dim. | Min. | Max. |
|---|---|---|
| A | 6.40 | 6.80 |
| B | 5.20 | 5.50 |
| C | 3.80 | ----- |
| D | 4.75 | ----- |
| E | 6.80 | 7.20 |
| F | 5.40 | 6.20 |
| G | 7.20 | 7.80 |
| H | 2.30 Ref. | |
| I | 0.50 | 0.90 |
| J | 0.60 | 1.00 |
| K | 2.20 | 2.4 |
| L | 0.45 | 0.55 |
| M | 0.9 | 1.50 |
| N | 0.45 | 0.60 |
| All Dimensions in millimeter | | |

## 5. Ordering information

| Part Number | Package | Delivery mode |
|---|---|---|
| PRM028N04E | TO-251 (I-PAK) | 75 pcs / Tube |

Mechanical

- Molder Plastic: UL Flammability Classification Rating 94V-0
- Device Weight : 0.01 ounces (0.3grams) - TO-251 (I-PAK)