# N-Channel Power MOSFET

30V, 52A, 8.5mΩ

## FEATURES

- Low $R_{DS(ON)}$ to minimize conductive Losses
- Low gate charge for fast power switching
- 100% UIS and $R_g$ tested
- Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

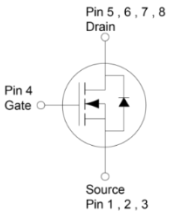
| PRODUCT SUMMARY | | | |
|---|---|---|---|
| **PARAMETER** | | **VALUE** | **UNIT** |
| $V_{DS}$ | | 30 | V |
| $R_{DS(on)}$ (max) | $V_{GS}$ = 10V | 8.5 | mΩ |
| | $V_{GS}$ = 4.5V | 13 | |
| $Q_g$ | | 7.2 | nC |

## APPLICATIONS

- DC-DC Converters
- Battery Power Management
- ORing FET/Load Switch

Pb-Free RoHS COMPLIANT HALOGEN FREE

**PDFN33**




**Notes:** MSL 1 (Moisture Sensitivity Level) per J-STD-020

| **ABSOLUTE MAXIMUM RATINGS** ($T_A$ = 25°C unless otherwise noted) | | | | |
|---|---|---|---|---|
| **PARAMETER** | | **SYMBOL** | **LIMIT** | **UNIT** |
| Drain-Source Voltage | | $V_{DS}$ | 30 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current (Note 1) | $T_C$ = 25°C | $I_D$ | 52 | A |
| | $T_A$ = 25°C | | 13 | |
| Pulsed Drain Current (Note 1) | | $I_{DM}$ | 208 | A |
| Single Pulse Avalanche Current (Note 2) | | $I_{AS}$ | 23 | A |
| Single Pulse Avalanche Energy (Note 2) | | $E_{AS}$ | 26 | mJ |
| Total Power Dissipation | $T_C$ = 25°C | $P_D$ | 37 | W |
| | $T_C$ = 125°C | | 7 | |
| Total Power Dissipation | $T_A$ = 25°C | $P_D$ | 2.3 | W |
| | $T_A$ = 125°C | | 0.5 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | - 55 to +150 | °C |

| **THERMAL RESISTANCE** | | | |
|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **LIMIT** | **UNIT** |
| Thermal Resistance – Junction to Case | $R_{\Theta JC}$ | 3.4 | °C/W |
| Thermal Resistance – Junction to Ambient | $R_{\Theta JA}$ | 53 | °C/W |

**Thermal Performance Note:** $R_{\Theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistances. The case-thermal reference is defined at the solder mounting surface of the drain pins. $R_{\Theta JA}$ is guaranteed by design while $R_{\Theta CA}$ is determined by the user's board design.

| ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **CONDITIONS** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = 250μA | $BV_{DSS}$ | 30 | -- | -- | V |
| Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA | $V_{GS(TH)}$ | 1 | 1.6 | 2.5 | V |
| Gate-Source Leakage Current | $V_{GS}$ = ±20V, $V_{DS}$ = 0V | $I_{GSS}$ | -- | -- | ±100 | nA |
| Drain-Source Leakage Current | $V_{GS}$ = 0V, $V_{DS}$ = 30V | $I_{DSS}$ | -- | -- | 1 | μA |
| Drain-Source On-State Resistance (Note 3) | $V_{GS}$ = 10V, $I_D$ = 13A | $R_{DS(on)}$ | -- | 6.2 | 8.5 | mΩ |
| | $V_{GS}$ = 4.5V, $I_D$ = 13A | | -- | 9 | 13 | |
| Forward Transconductance (Note 3) | $V_{DS}$ = 5V, $I_D$ = 13A | $g_{fs}$ | -- | 27 | -- | S |
| **Dynamic** (Note 4) | | | | | | |
| Total Gate Charge | $V_{GS}$ = 10V, $V_{DS}$ = 15V, $I_D$ = 13A | $Q_g$ | -- | 14.3 | -- | nC |
| Total Gate Charge | $V_{GS}$ = 4.5V, $V_{DS}$ = 15V, $I_D$ = 13A | $Q_g$ | | 7.2 | | |
| Gate-Source Charge | | $Q_{gs}$ | -- | 2.6 | -- | |
| Gate-Drain Charge | | $Q_{gd}$ | -- | 3.4 | -- | |
| Input Capacitance | $V_{GS}$ = 0V, $V_{DS}$ = 15V, f = 1.0MHz | $C_{iss}$ | -- | 817 | -- | pF |
| Output Capacitance | | $C_{oss}$ | -- | 155 | -- | |
| Reverse Transfer Capacitance | | $C_{rss}$ | -- | 96 | -- | |
| Gate Resistance | f = 1.0MHz, open drain | $R_g$ | 0.8 | 2.8 | 5.6 | Ω |
| **Switching** (Note 4) | | | | | | |
| Turn-On Delay Time | $V_{GS}$ = 10V, $V_{DS}$ = 15V, $I_D$ = 15A, $R_G$ = 3.3Ω, | $t_{d(on)}$ | -- | 4.8 | -- | ns |
| Rise Time | | $t_r$ | -- | 12.5 | -- | |
| Turn-Off Delay Time | | $t_{d(off)}$ | -- | 27.6 | -- | |
| Fall Time | | $t_f$ | -- | 8.2 | -- | |
| **Source-Drain Diode** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{GS}$ = 0V, $I_S$ = 13A | $V_{SD}$ | -- | -- | 1 | V |
| Reverse Recovery Time | $I_S$ = 13A, di/dt = 100A/μs | $t_{rr}$ | -- | 13 | -- | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | -- | 6.3 | -- | nC |

**Notes:**

1. Current limited by package.
2. L = 0.1mH, $V_{GS}$ = 10V, $V_{DS}$ = 25V, $R_G$ = 25Ω, $I_{AS}$ = 23A, Starting $T_J$ = 25°C
3. Pulse test: Pulse Width ≤ 300μs, duty cycle ≤ 2%.
4. Switching time is essentially independent of operating temperature.

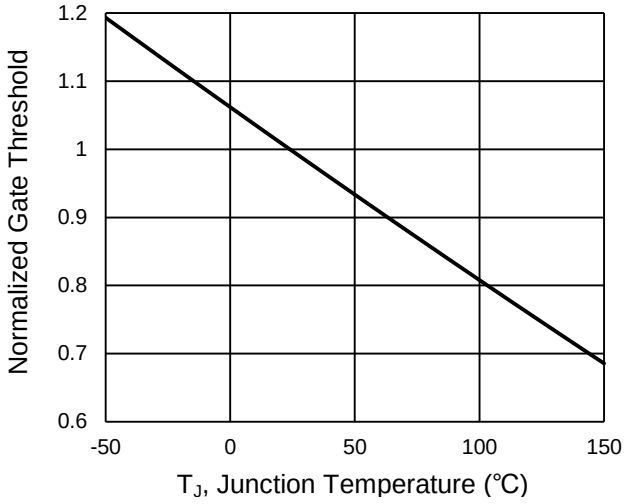
## ORDERING INFORMATION

| PART NO. | PACKAGE | PACKING |
|---|---|---|
| TSM085N03PQ33 RGG | PDFN33 | 5,000pcs / 13” Reel |

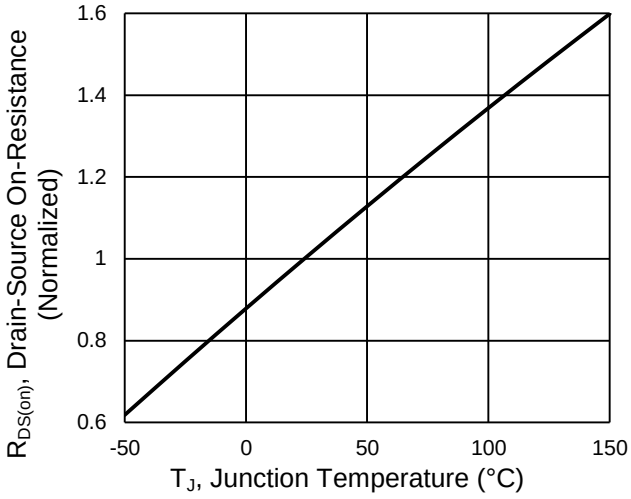
## CHARACTERISTICS CURVES

($T_A$ = 25°C unless otherwise noted)

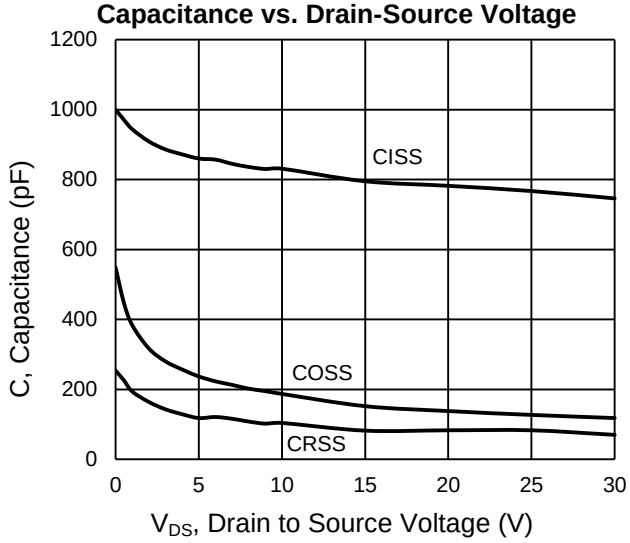
**Normalized $V_{th}$ vs. $T_J$**



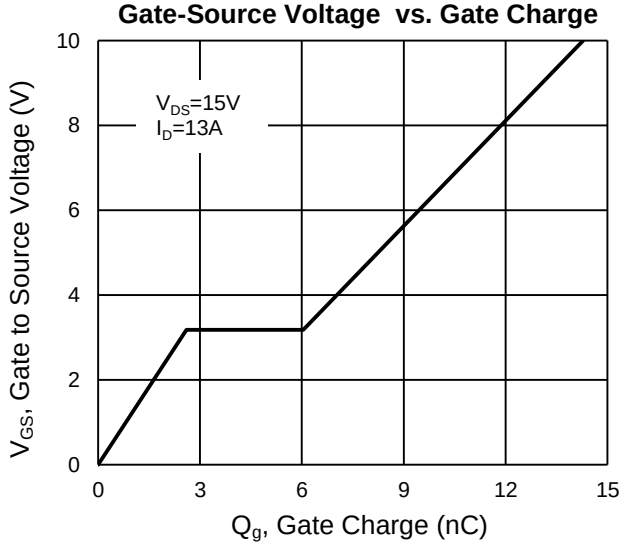

**On-Resistance vs. Junction Temperature**



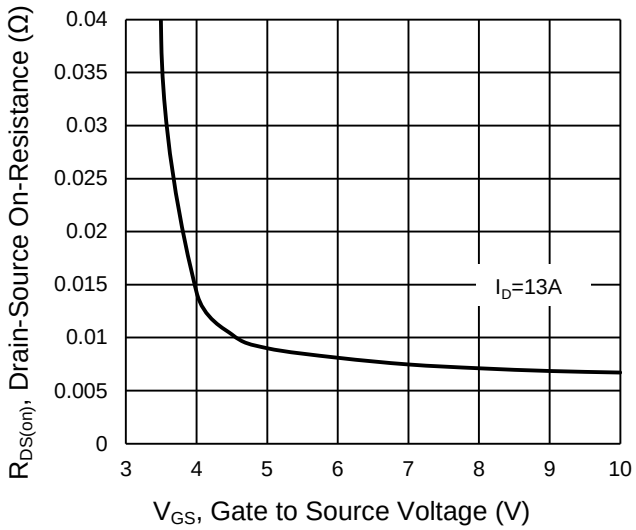

**Capacitance vs. Drain-Source Voltage**



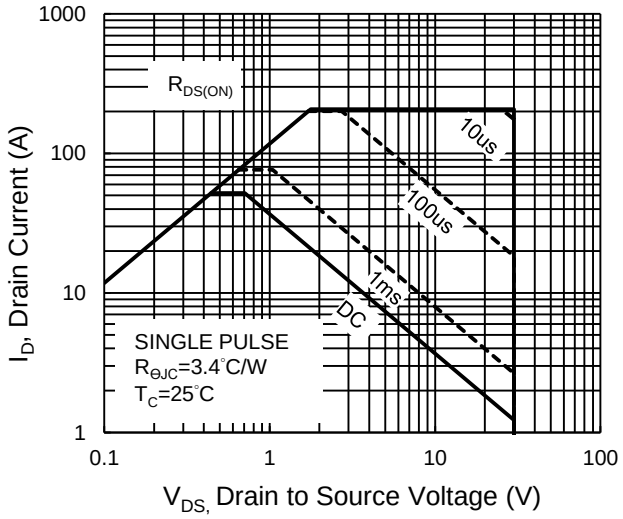

**Gate-Source Voltage vs. Gate Charge**




**On-Resistance vs. Gate-Source Voltage**

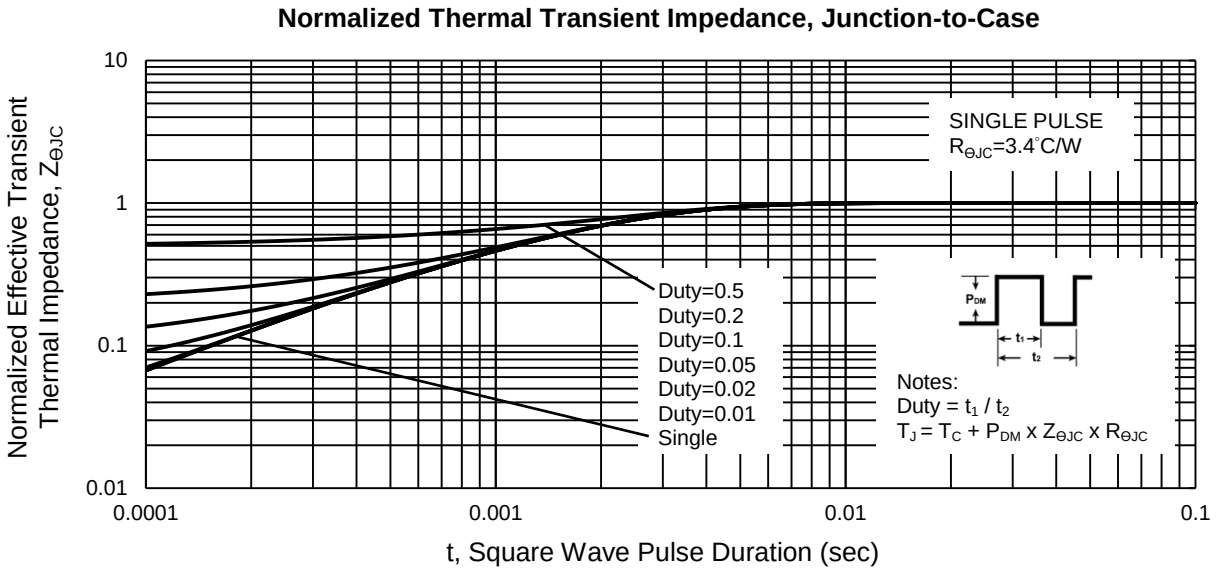



**Maximum Safe Operating Area, Junction-to-Case**



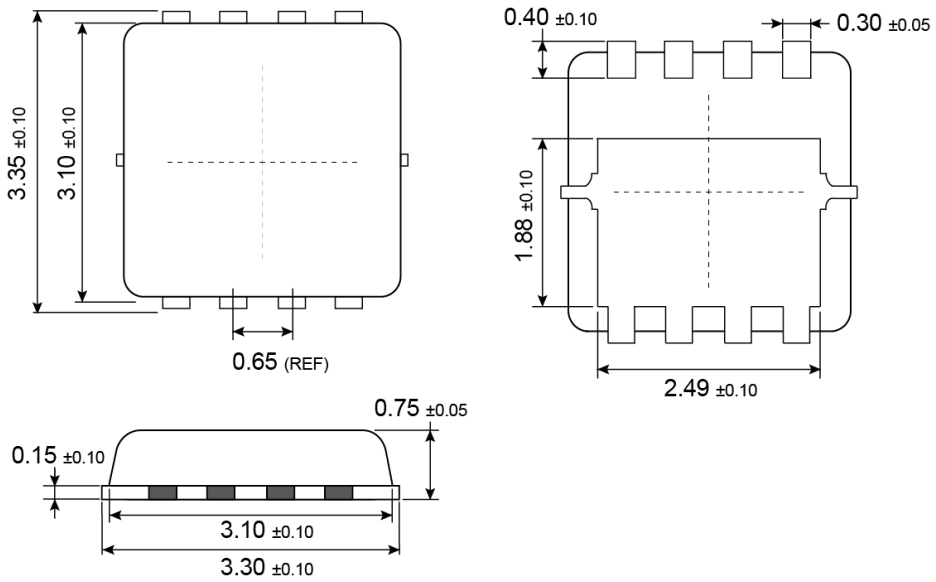
## CHARACTERISTICS CURVES

($T_A$ = 25°C unless otherwise noted)

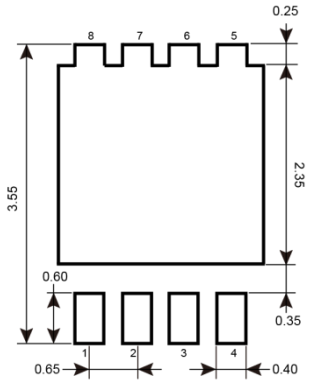


## PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

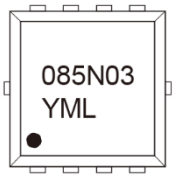
**PDFN33**




## SUGGESTED PAD LAYOUT (Unit: Millimeters)




## MARKING DIAGRAM




**Y** = Year Code

**M** = Month Code for Halogen Free Product

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **O** | =Jan | **P** | =Feb | **Q** | =Mar | **R** | =Apr |
| **S** | =May | **T** | =Jun | **U** | =Jul | **V** | =Aug |
| **W** | =Sep | **X** | =Oct | **Y** | =Nov | **Z** | =Dec |

**L** = Lot Code (1~9, A~Z)

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