

## Features

- Fully Automotive Qualified to AEC-Q101
- Split Gate Trench MOSFET Technology
- Excellent Package For Heat Dissipation
- Moisture Sensitivity Level 1
- Halogen Free. "Green" Device (Note 1)
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant ("P" Suffix Designates RoHS Compliant. See Ordering Information)

## Maximum Ratings

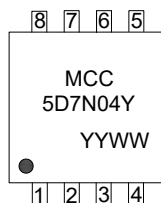
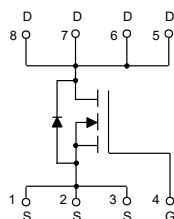
- Operating Junction Temperature Range : -55°C to +175°C
- Storage Temperature Range: -55°C to +175°C
- Thermal Resistance: 65°C/W Junction to Ambient (Note 2)
- Thermal Resistance: 2.6°C/W Junction to Case

| Parameter                               | Symbol   | Rating | Unit |
|-----------------------------------------|----------|--------|------|
| Drain-Source Voltage                    | $V_{DS}$ | 40     | V    |
| Gate-Source Voltage                     | $V_{GS}$ | ±20    | V    |
| Continuous Drain Current                | $I_D$    | 69     | A    |
|                                         |          | 48     |      |
| Pulsed Drain Current (Note 3)           | $I_{DM}$ | 276    | A    |
| Total Power Dissipation (Note 4)        | $P_D$    | 57     | W    |
| Single Pulsed Avalanche Energy (Note 5) | $E_{AS}$ | 82     | mJ   |

Note:

- Halogen free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
- The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A = 25^\circ\text{C}$ .
- Repetitive rating; pulse width limited by max. junction temperature.
- $P_D$  is based on max. junction temperature, using junction-case thermal resistance.
- $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 40\text{V}$ ,  $V_{GS} = 10\text{V}$ ,  $L = 0.5\text{mH}$ .

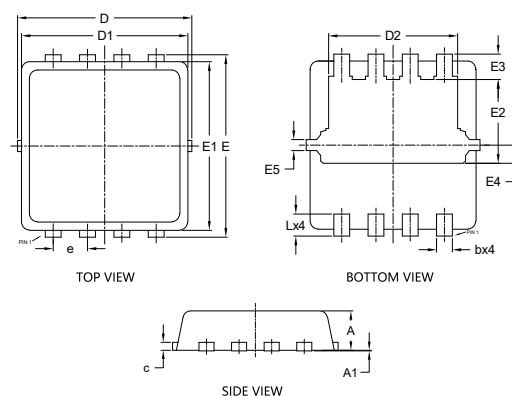
## Internal Structure and Marking Code



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

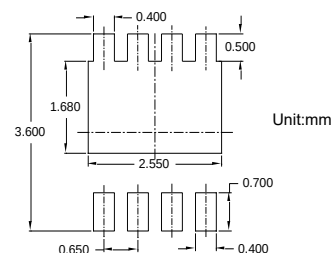
# N-CHANNEL MOSFET

## PDFN3333



| DIMENSIONS |        |       |       |       |      |
|------------|--------|-------|-------|-------|------|
| DIM        | INCHES |       | MM    |       | NOTE |
|            | MIN    | MAX   | MIN   | MAX   |      |
| A          | 0.028  | 0.033 | 0.70  | 0.85  |      |
| A1         | 0.000  | 0.002 | 0.00  | 0.05  |      |
| b          | 0.008  | 0.016 | 0.20  | 0.40  |      |
| c          | 0.004  | 0.010 | 0.10  | 0.25  |      |
| D          | 0.124  | 0.136 | 3.15  | 3.45  |      |
| D1         | 0.118  | 0.130 | 3.00  | 3.30  |      |
| D2         | 0.089  | 0.104 | 2.25  | 2.65  |      |
| E          | 0.124  | 0.136 | 3.15  | 3.45  |      |
| E1         | 0.114  | 0.126 | 2.90  | 3.20  |      |
| E2         | 0.052  | 0.068 | 1.32  | 1.72  |      |
| E3         | 0.011  | 0.026 | 0.28  | 0.65  |      |
| E4         | 0.013  |       | 0.330 |       | TYP  |
| E5         | 0.008  |       | 0.200 |       | TYP  |
| e          | 0.026  |       | 0.650 |       | BSC  |
| L          | 0.012  | 0.020 | 0.300 | 0.500 |      |

## Suggested Solder Pad Layout

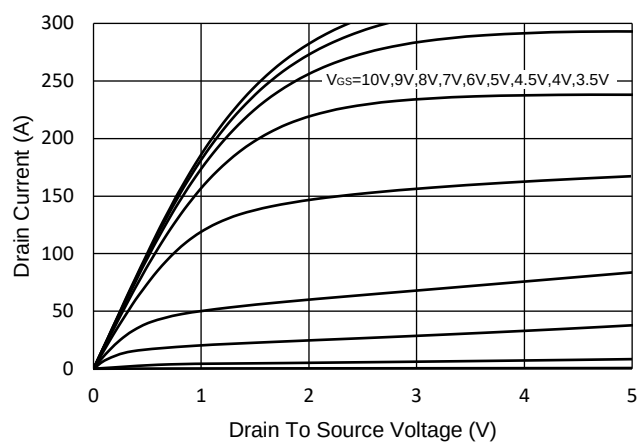


# Electrical Characteristics @ 25°C (Unless Otherwise Specified)

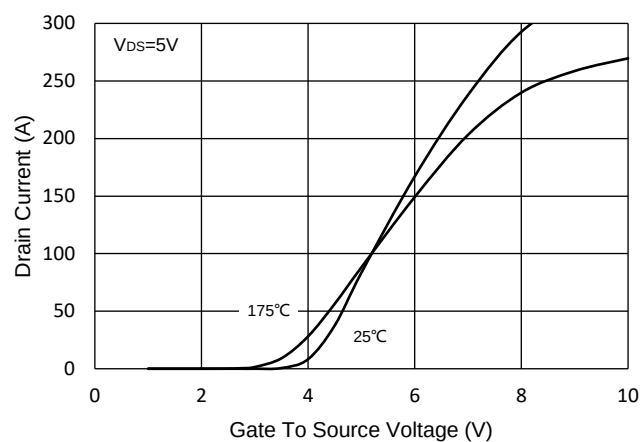
| Parameter                       | Symbol               | Test Conditions                                                                         | Min | Typ  | Max  | Unit |
|---------------------------------|----------------------|-----------------------------------------------------------------------------------------|-----|------|------|------|
| Static Characteristics          |                      |                                                                                         |     |      |      |      |
| Drain-Source Breakdown Voltage  | V <sub>(BR)DSS</sub> | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                              | 40  |      |      | V    |
| Gate-Source Leakage Current     | I <sub>GSS</sub>     | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                              |     |      | ±100 | nA   |
| Zero Gate Voltage Drain Current | I <sub>DSS</sub>     | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V                                               |     |      | 1    | μA   |
| Gate-Threshold Voltage          | V <sub>GS(th)</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                | 2   | 3    | 4    | V    |
| Drain-Source On-Resistance      | R <sub>DS(on)</sub>  | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                                               |     | 4.2  | 5.7  | mΩ   |
| Gate Resistance                 | R <sub>g</sub>       | f=1 MHz, Open drain                                                                     |     | 2    |      | Ω    |
| Diode Characteristics           |                      |                                                                                         |     |      |      |      |
| Continuous Body Diode Current   | I <sub>S</sub>       |                                                                                         |     |      | 69   | A    |
| Diode Forward Voltage           | V <sub>SD</sub>      | V <sub>GS</sub> =0V, I <sub>S</sub> =20A                                                |     |      | 1.2  | V    |
| Reverse Recovery Time           | t <sub>rr</sub>      | I <sub>F</sub> =30A, dI <sub>F</sub> /dt=100A/μs                                        |     | 56   |      | ns   |
| Reverse Recovery Charge         | Q <sub>rr</sub>      |                                                                                         |     | 49   |      | nC   |
| Dynamic Characteristics         |                      |                                                                                         |     |      |      |      |
| Input Capacitance               | C <sub>iss</sub>     | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, f=1MHz                                       |     | 1080 |      | pF   |
| Output Capacitance              | C <sub>oss</sub>     |                                                                                         |     | 460  |      |      |
| Reverse Transfer Capacitance    | C <sub>rss</sub>     |                                                                                         |     | 3    |      |      |
| Total Gate Charge               | Q <sub>g</sub>       | V <sub>DS</sub> =30V, V <sub>GS</sub> =10V, I <sub>D</sub> =20A                         |     | 14.5 |      | nC   |
| Gate-Source Charge              | Q <sub>gs</sub>      |                                                                                         |     | 5.2  |      |      |
| Gate-Drain Charge               | Q <sub>gd</sub>      |                                                                                         |     | 3    |      |      |
| Turn-On Delay Time              | t <sub>d(on)</sub>   | V <sub>DD</sub> =20V, V <sub>GS</sub> =10V, R <sub>GEN</sub> =2.2Ω, I <sub>D</sub> =30A |     | 10   |      | ns   |
| Turn-On Rise Time               | t <sub>r</sub>       |                                                                                         |     | 154  |      |      |
| Turn-Off Delay Time             | t <sub>d(off)</sub>  |                                                                                         |     | 15   |      |      |
| Turn-Off Fall Time              | t <sub>f</sub>       |                                                                                         |     | 8    |      |      |

## Curve Characteristics

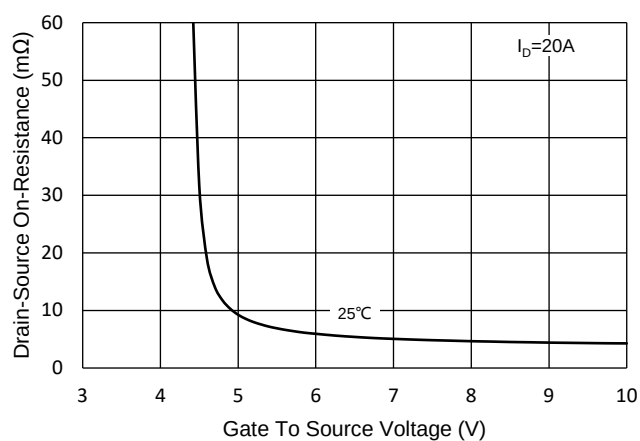
**Fig.1 - Typical Output Characteristics**



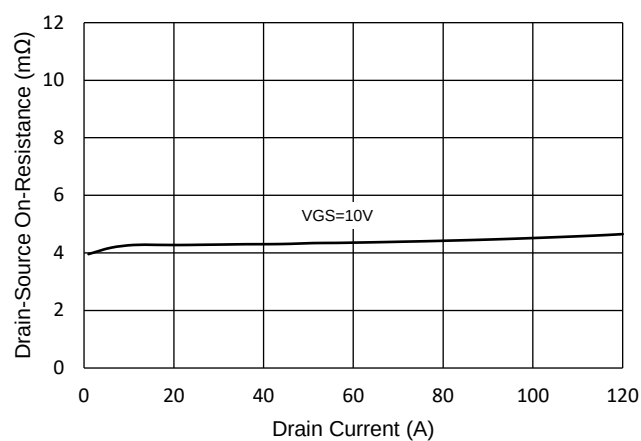
**Fig.2 - Transfer Characteristic**



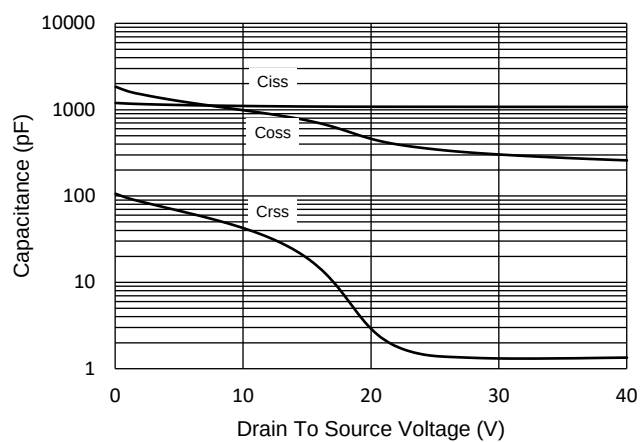
**Fig.3 -  $R_{DS(ON)}$  -  $V_{GS}$**



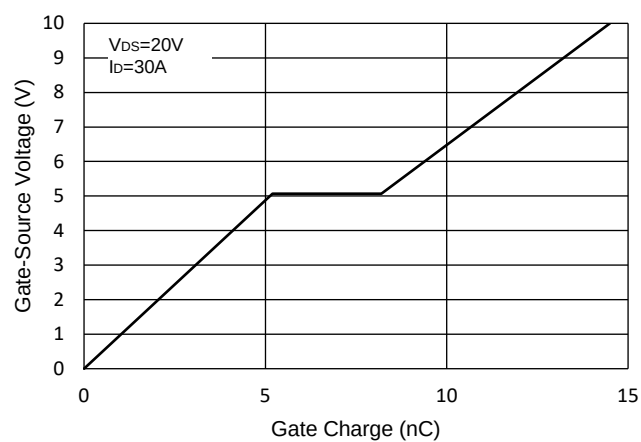
**Fig.4 -  $R_{DS(ON)}$  -  $I_D$**



**Fig.5 - Capacitance Characteristics**



**Fig.6 - Gate Charge**



## Curve Characteristics

Fig.7 - Normalized Threshold Voltage

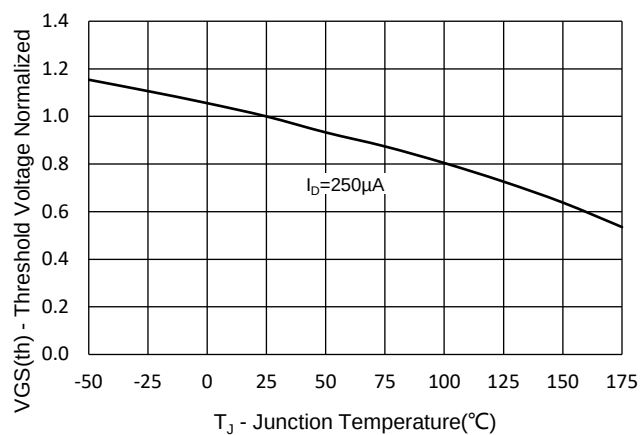


Fig.8 - Normalized On Resistance Characteristics

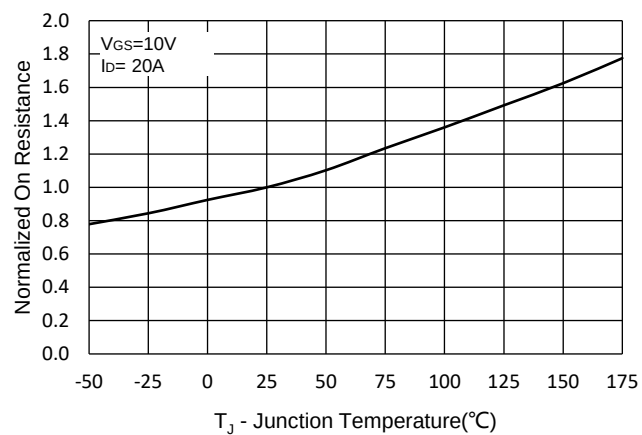


Fig.9 -  $I_S - V_{SD}$

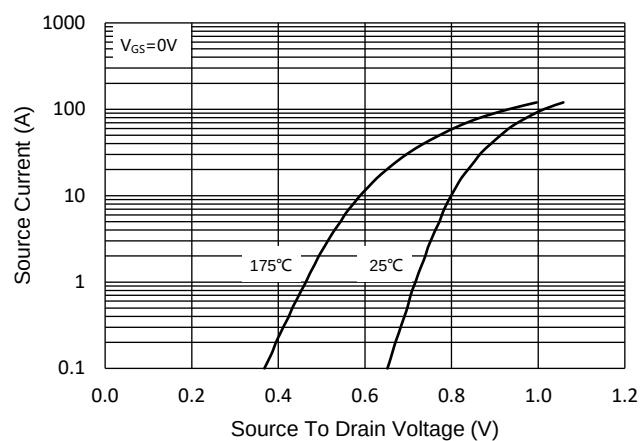


Fig.10 - Drain Current

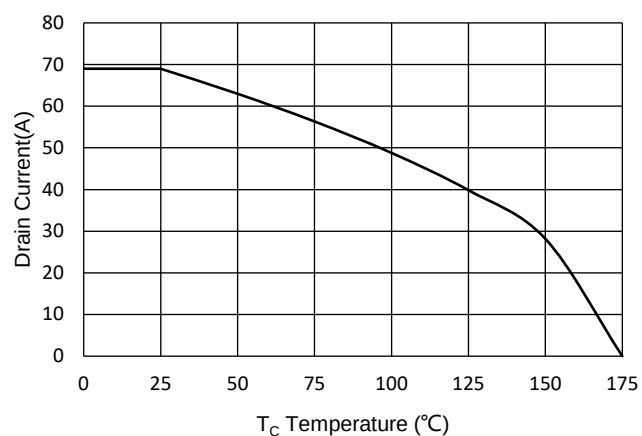
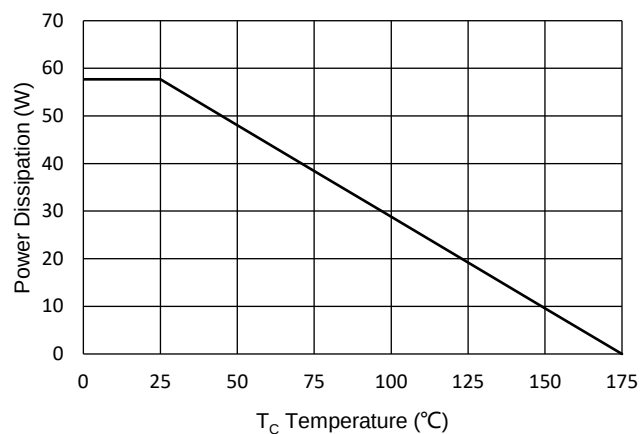


Fig.11 - PD Dissipation



## Curve Characteristics

Fig.12 - Safe Operation Area

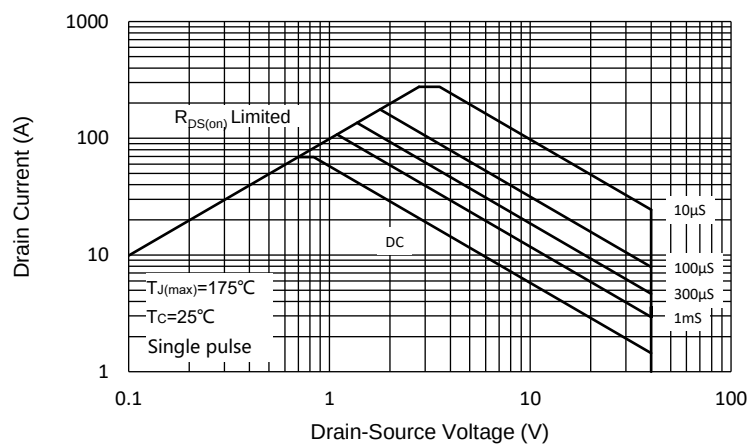
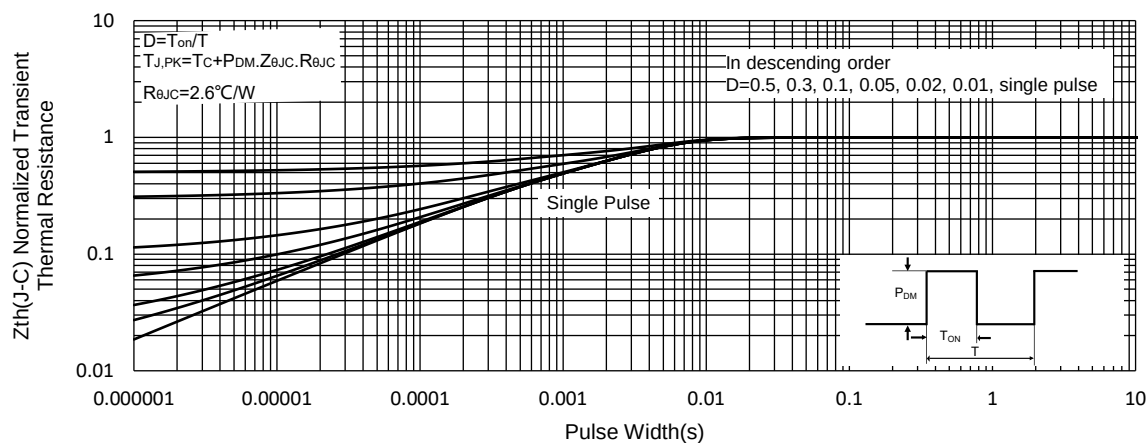


Fig.13 - Normalized Transient Thermal Impedance



### Ordering Information

| Device         | Packing               |
|----------------|-----------------------|
| Part Number-TP | Tape&Reel: 5Kpcs/Reel |

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