

# TMP4020D

## P -Channel Enhancement Mosfet

### General Description

- Low  $R_{DS(ON)}$
- RoHS and Halogen-Free Compliant

### Applications

- Load switch
- PWM

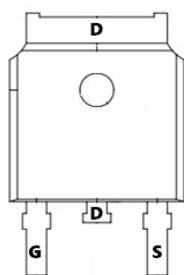
### General Features

$V_{DS} = -40V$   $I_D = -20A$

$R_{DS(ON)} = 36m\Omega (typ.) @ V_{GS} = -10V$

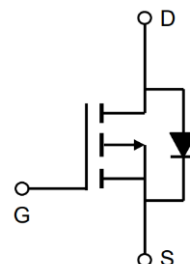
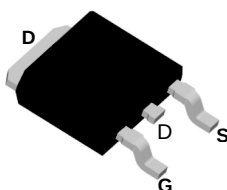
100% UIS Tested

100%  $R_g$  Tested



Marking: 20P04

D:TO-252-3L



### Absolute Maximum Ratings ( $T_A = 25^\circ C$ Unless Otherwise Noted)

| Symbol         | Parameter                                        | Ratings     | Units      |
|----------------|--------------------------------------------------|-------------|------------|
| $V_{DS}$       | Drain-Source Voltage                             | -40         | V          |
| $V_{GS}$       | Gate-Source Voltage                              | $\pm 20$    | V          |
| $I_D$          | Continuous Drain Current- $T_C=25^\circ C$       | -20         | A          |
| $I_{DM}$       | Pulsed Drain Current <sup>1</sup>                | -80         | A          |
| $P_D$          | Total Power Dissipation                          | 34          | W          |
| $E_{AS}$       | Single Pulsed Avalanche Energy <sup>2</sup>      | 40.6        | mJ         |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to +175 | $^\circ C$ |

### Thermal Characteristics:

| Symbol          | Parameter                            | Max  | Units        |
|-----------------|--------------------------------------|------|--------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 3.67 | $^\circ C/W$ |



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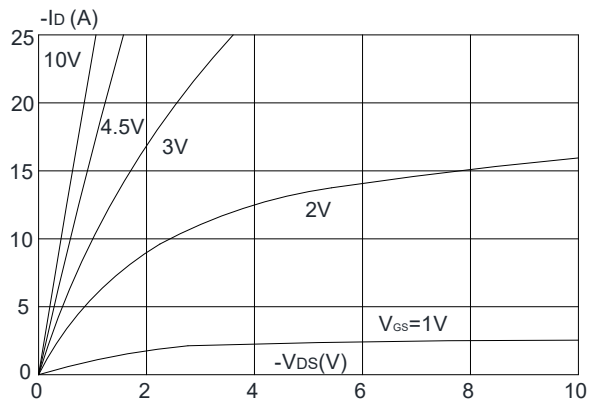
Electrical Characteristics: ( $T_C=25^{\circ}\text{C}$  unless otherwise noted)

| Symbol                             | Parameter                                      | Conditions                                                                                  | Min | Typ  | Max   | Units |
|------------------------------------|------------------------------------------------|---------------------------------------------------------------------------------------------|-----|------|-------|-------|
| Off Characteristics                |                                                |                                                                                             |     |      |       |       |
| BV <sub>DSS</sub>                  | Drain-Sourtce Breakdown Voltage                | V <sub>GS</sub> =0V, I <sub>D</sub> =-250 μ A                                               | -40 | ---  | ---   | V     |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current                | V <sub>GS</sub> =0V, V <sub>DS</sub> =-40V                                                  | --- | ---  | -1    | μ A   |
| I <sub>GSS</sub>                   | Gate-Source Leakage Current                    | V <sub>GS</sub> = ± 20V, V <sub>DS</sub> =0A                                                | --- | ---  | ± 100 | nA    |
| On Characteristics                 |                                                |                                                                                             |     |      |       |       |
| V <sub>GS(th)</sub>                | GATE-Source Threshold Voltage                  | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250 μ A                                 | -1  | -1.6 | -2.5  | V     |
| R <sub>DS(ON)</sub>                | Static Drain-Source On-Resistance <sup>3</sup> | V <sub>GS</sub> =-10V, I <sub>D</sub> =-8A                                                  | --- | 36   | 50    | m Ω   |
|                                    |                                                | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-5A                                                 | --- | 49   | 60    |       |
| Dynamic Characteristics            |                                                |                                                                                             |     |      |       |       |
| C <sub>iss</sub>                   | Input Capacitance                              | V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, f=1MHz                                          | --- | 1033 | ---   | pF    |
| C <sub>oss</sub>                   | Output Capacitance                             |                                                                                             | --- | 106  | ---   |       |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance                   |                                                                                             | --- | 79   | ---   |       |
| Switching Characteristics          |                                                |                                                                                             |     |      |       |       |
| t <sub>d(on)</sub>                 | Turn-On Delay Time                             | V <sub>DD</sub> =-20V, I <sub>D</sub> =-5A,<br>V <sub>GS</sub> =-10V, R <sub>G</sub> =2.5 Ω | --- | 7    | ---   | ns    |
| t <sub>r</sub>                     | Rise Time                                      |                                                                                             | --- | 14   | ---   | ns    |
| t <sub>d(off)</sub>                | Turn-Off Delay Time                            |                                                                                             | --- | 22   | ---   | ns    |
| t <sub>f</sub>                     | Fall Time                                      |                                                                                             | --- | 8    | ---   | ns    |
| Q <sub>g</sub>                     | Total Gate Charge                              | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-20V,<br>I <sub>D</sub> =-5A                        | --- | 19   | ---   | nC    |
| Q <sub>gs</sub>                    | Gate-Source Charge                             |                                                                                             | --- | 3.4  | ---   | nC    |
| Q <sub>gd</sub>                    | Gate-Drain “Miller” Charge                     |                                                                                             | --- | 4.1  | ---   | nC    |
| Drain-Source Diode Characteristics |                                                |                                                                                             |     |      |       |       |
| V <sub>SD</sub>                    | Drain Diode Forward Voltage <sup>2</sup>       | V <sub>GS</sub> =0V, I <sub>S</sub> =-10A                                                   | --- | -0.8 | -1.2  | V     |
| I <sub>S</sub>                     | Continuous Source Current                      | V <sub>G</sub> =V <sub>D</sub> =0V                                                          | --- | ---  | -20   | A     |
| I <sub>sm</sub>                    | Pulsed Drain Current                           | V <sub>G</sub> =V <sub>D</sub> =0V                                                          | --- | ---  | -80   | A     |
| Q <sub>rr</sub>                    | Reverse Recovery Charge                        | V <sub>G</sub> S =0V, I <sub>S</sub> =-5A,                                                  | --- | 20   | ---   | nC    |
| t <sub>rr</sub>                    | Reverse Recovery Time                          | di/dt=100A/μs                                                                               | --- | 29   | ---   | ns    |

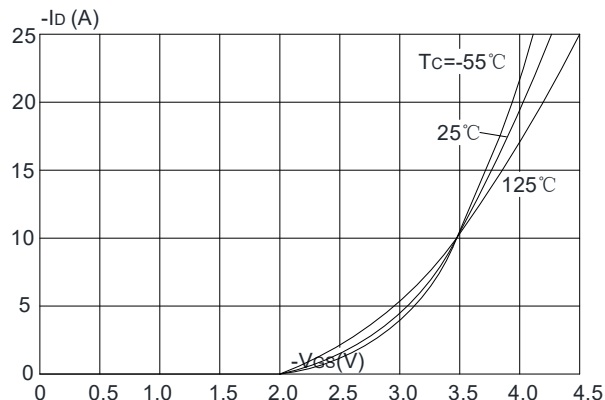
**Notes:**

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. EAS condition:  $T_J=25^{\circ}\text{C}$ ,  $V_{DD}=-20V$ ,  $V_G=-10V$ ,  $L=0.5mH$ ,  $R_G=25\Omega$ ,  $I_{AS}=-10.5A$
3. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 2\%$

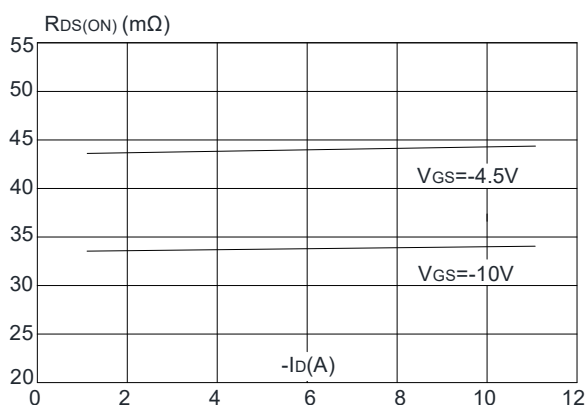
## Typical Characteristics



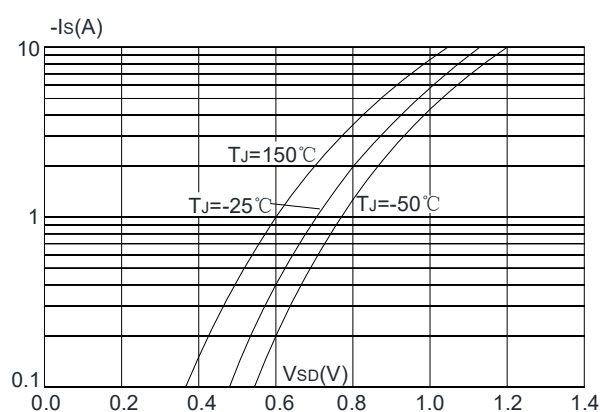
**Figure1:** Output Characteristics



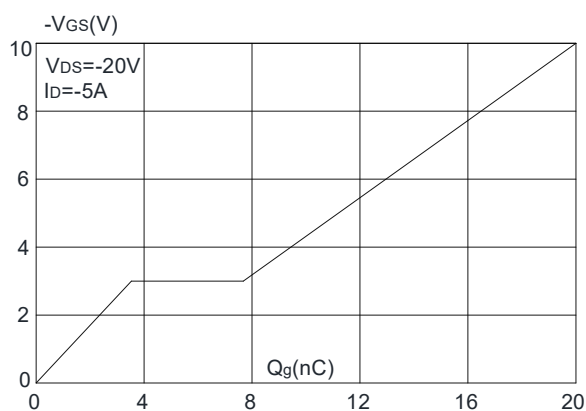
**Figure 2:** Typical Transfer Characteristics



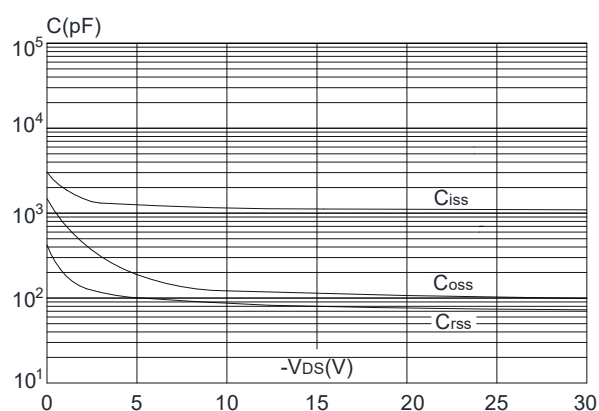
**Figure 3:** On-resistance vs. Drain Current



**Figure 4:** Body Diode Characteristics



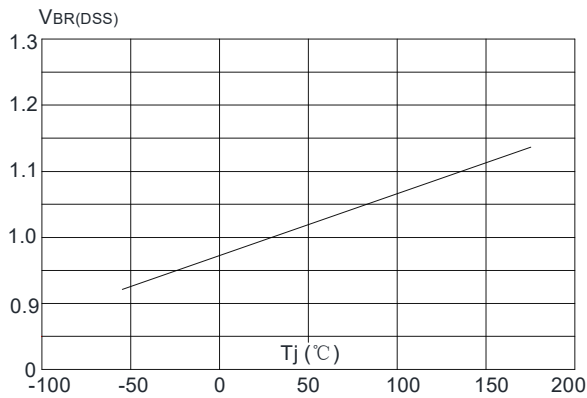
**Figure 5:** Gate Charge Characteristics



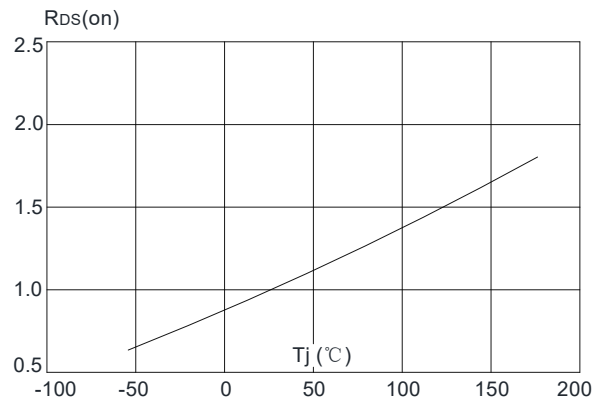
**Figure 6:** Capacitance Characteristics

TMP4020D

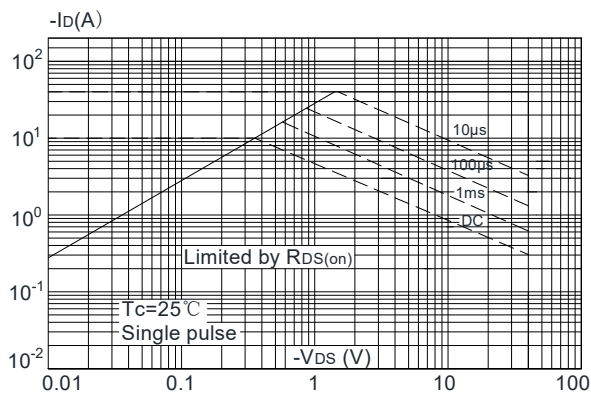
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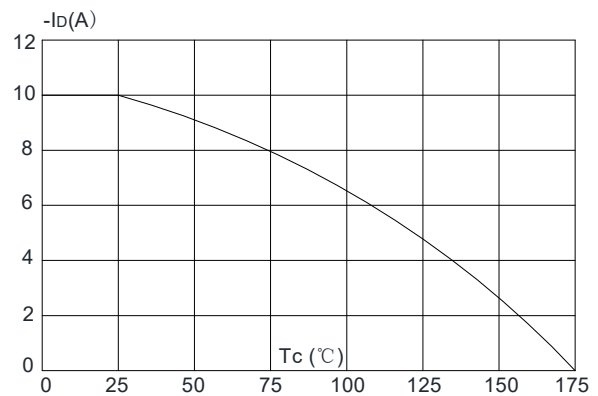
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



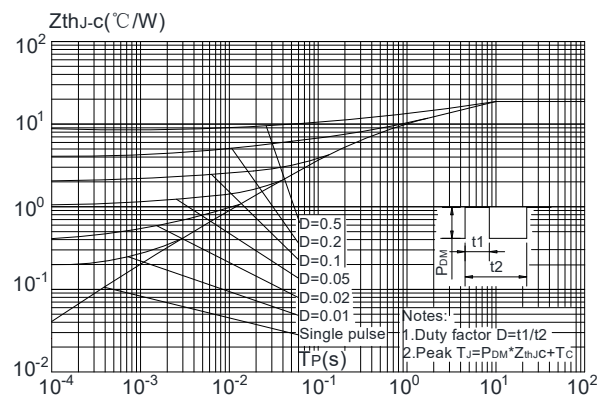
**Figure 8:** Normalized on Resistance vs. Junction Temperature



**Figure 9:** Maximum Safe Operating Area

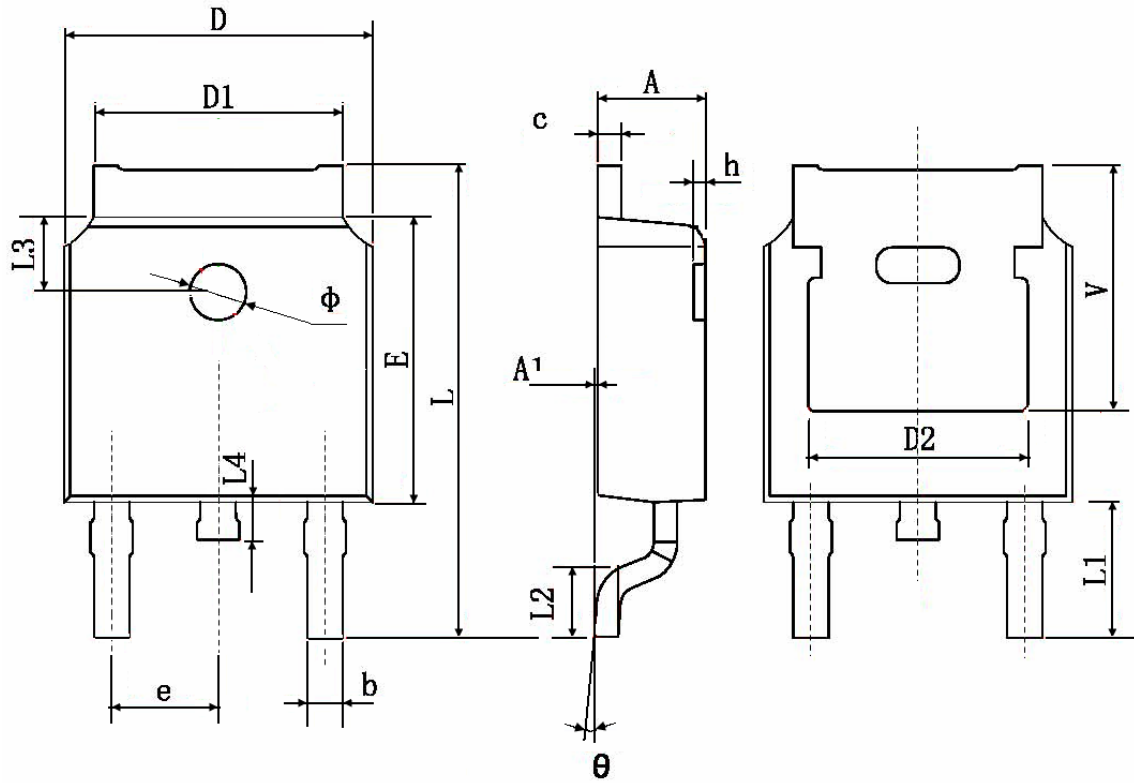


**Figure 10:** Maximum Continuous Drain Current vs. Case Temperature



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Case

## Package Information:TO-252-3L



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 2.200                     | 2.400  | 0.087                | 0.094 |
| A1     | 0.000                     | 0.127  | 0.000                | 0.005 |
| b      | 0.660                     | 0.860  | 0.026                | 0.034 |
| c      | 0.460                     | 0.580  | 0.018                | 0.023 |
| D      | 6.500                     | 6.700  | 0.256                | 0.264 |
| D1     | 5.100                     | 5.460  | 0.201                | 0.215 |
| D2     | 4.830 TYP.                |        | 0.190 TYP.           |       |
| E      | 6.000                     | 6.200  | 0.236                | 0.244 |
| e      | 2.186                     | 2.386  | 0.086                | 0.094 |
| L      | 9.800                     | 10.400 | 0.386                | 0.409 |
| L1     | 2.900 TYP.                |        | 0.114 TYP.           |       |
| L2     | 1.400                     | 1.700  | 0.055                | 0.067 |
| L3     | 1.600 TYP.                |        | 0.063 TYP.           |       |
| L4     | 0.600                     | 1.000  | 0.024                | 0.039 |
| Φ      | 1.100                     | 1.300  | 0.043                | 0.051 |
| θ      | 0°                        | 8°     | 0°                   | 8°    |
| h      | 0.000                     | 0.300  | 0.000                | 0.012 |
| V      | 5.350 TYP.                |        | 0.211 TYP.           |       |