



**WANSEMI**  
万芯半导体

**WP4060K**

# **Enhancement Mode N-Channel Power MOSFET**

TO-252/NMOS/40V/ $\pm 20$ V/1.9V/60A/5.5m $\Omega$

Rev0.6

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## 40V, 5.5mΩ, 60A, Single N-Channel

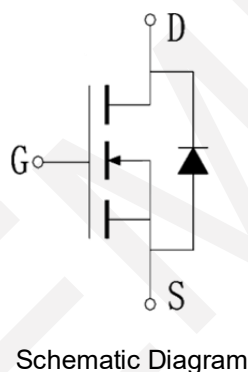
### 1.Features

- ◆ 40V MOSFET technology
- ◆ Low on-state resistance
- ◆ Fast switching
- ◆  $V_{GS} \pm 20V$

| $V_{DS}$ | $R_{DS(on)}$ Typ. | $I_D$ Max. |
|----------|-------------------|------------|
| 40V      | 5.5mΩ @ 10V       | 60A        |
|          | 7.5mΩ @ 4.5V      |            |

### 2.Applications

- ◆ Power Switching Application
- ◆ Load Switching



### 3.Package Marking and Ordering Information

| Part no. | Marking | Package | PCS/Reel | PCS/CTN. |
|----------|---------|---------|----------|----------|
| WP4060K  | WP4060K | TO-252  | 2500     | 25000    |

### 4.Absolute Max Ratings at $T_a = 25^\circ C$ (Note1)

| Parameter                                 | Symbol    | Maximum     | Units      |
|---|-----------|-------------|------------|
| Drain to Source Voltage                   | $V_{DSS}$ | 40          | V          |
| Gate to Source Voltage                    | $V_{GSS}$ | $\pm 20$    | V          |
| Drain Current (DC)                        | $I_D$     | 60          | A          |
| Drain Current (Pulse), $PW \leq 300\mu s$ | $I_{DP}$  | 320         | A          |
| Total Dissipation                         | $P_D$     | 80          | W          |
| Avalanche Energy, Single Pulsed           | $E_{AS}$  | 196         | mJ         |
| Junction Temperature                      | $T_j$     | 150         | $^\circ C$ |
| Storage Temperature                       | $T_{stg}$ | -55 to +150 | $^\circ C$ |

Note 1: Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

## 5. Thermal Resistance Ratings

| Parameter                            | Symbol          | Value | Unit                 |
|--------------------------------------|-----------------|-------|----------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 2.8   | $^{\circ}\text{C/W}$ |

Note 2: When mounted on 1 inch square copper board  $t \leq 10\text{sec}$  The value in any given application depends on the user's specific board design.

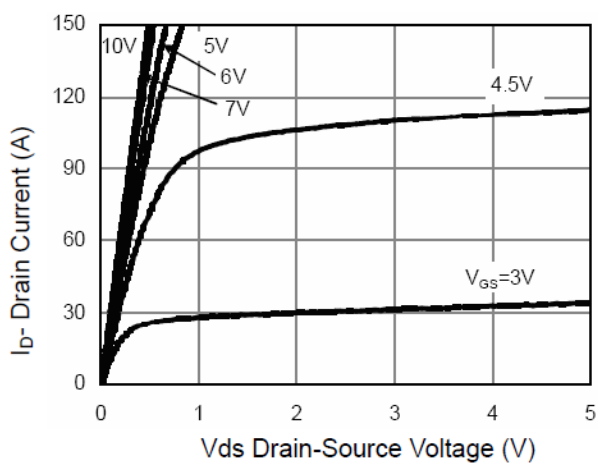
## 6. Electrical Characteristics at $T_a=25^{\circ}\text{C}$ (Note 3)

| Parameter                                  | Symbol        | Test Conditions  | Min. | Typ. | Max.      | Units            |
|--|---------------|--|------|------|-----------|------------------|
| Drain to Source Breakdown Voltage          | $V_{(BR)DSS}$ | $I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$                                      | 40   |      |           | V                |
| Zero-Gate Voltage Drain Current            | $I_{DSS}$     | $V_{DS} = 20\text{V}$ , $V_{GS} = 0\text{V}$                                       |      |      | 1         | $\mu\text{A}$    |
| Gate to Source Leakage Current             | $I_{GSS}$     | $V_{GS} = \pm 12\text{V}$ , $V_{DS} = 0\text{V}$                                   |      |      | $\pm 100$ | nA               |
| Gate Threshold Voltage                     | $V_{GS(th)}$  | $V_{DS}=V_{GS}$ , $I_{DS}=250\mu\text{A}$  | 1    | 1.9  | 2.5       | V                |
| Static Drain to Source On-State Resistance | $R_{DS(on)}$  | $I_D = 20\text{A}$ , $V_{GS} = 10\text{V}$   | -    | 5.5  | 7         | $\text{m}\Omega$ |
|  |               | $I_D = 10\text{A}$ , $V_{GS} = 4.5\text{V}$  | -    | 7.5  | 13        | $\text{m}\Omega$ |
| Forward Transconductance                   | $G_{FS}$      | $I_D = 20\text{A}$ , $V_{DS} = 10\text{V}$   | 15   |      |           | S                |
| Input Capacitance                          | $C_{iss}$     | $V_{GS}=0\text{V}$ ,<br>$V_{DS}=20\text{V}$ ,<br>Frequency=1.0MHz                  |      | 2662 |           | pF               |
| Output Capacitance                         | $C_{oss}$     |  |      | 322  |           | pF               |
| Reverse Transfer Capacitance               | $C_{rss}$     |  |      | 246  |           | pF               |
| Turn-ON Delay Time                         | $t_{d(on)}$   |  |      | 12   |           | ns               |
| Rise Time                                  | $t_r$         | $V_{DD} = 20\text{V}$ , $R_L = 1\Omega$<br>$V_{GS} = 10\text{V}$ , $R_G = 3\Omega$ |      | 11   |           | ns               |
| Turn-OFF Delay Time                        | $t_{d(off)}$  |  |      | 39   |           | ns               |
| Fall Time                                  | $t_f$         |  |      | 12   |           | ns               |
| Total Gate Charge                          | $Q_g$         | $V_{DS} = 20\text{V}$ ,<br>$V_{GS} = 10\text{V}$ ,<br>$I_D = 20\text{A}$           |      | 54.3 |           | nC               |
|  | $Q_{gs}$      |  |      | 6.9  |           | nC               |
|  | $Q_{gd}$      |  |      | 14.5 |           | nC               |
| Diode Forward Voltage                      | $V_{FSD}$     | $I_S = 10\text{A}$ , $V_{GS} = 0$  |      | 0.85 | 1.2       | V                |

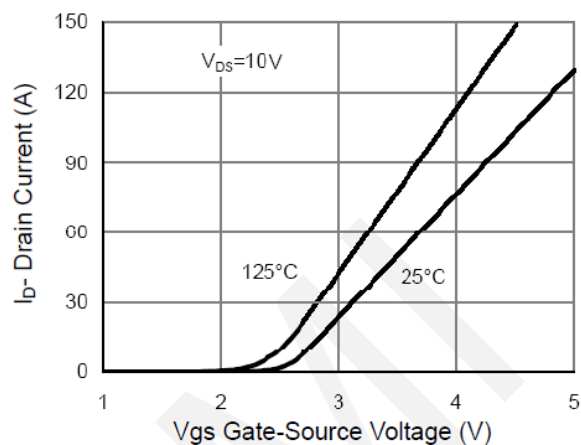
Note 3: Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.



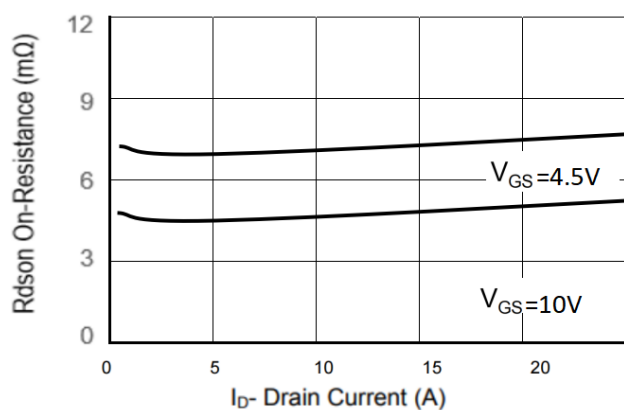
## 7. Typical electrical and thermal characteristics



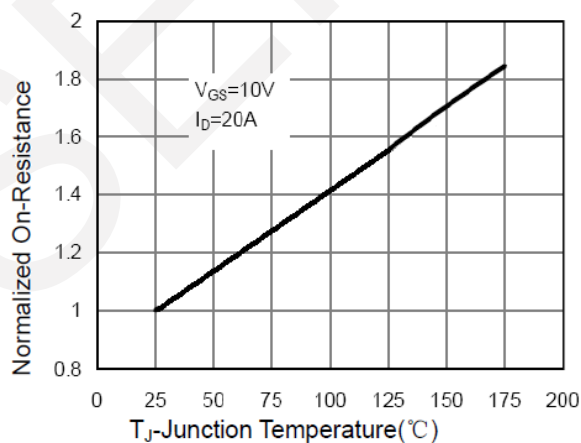
Output Characteristics



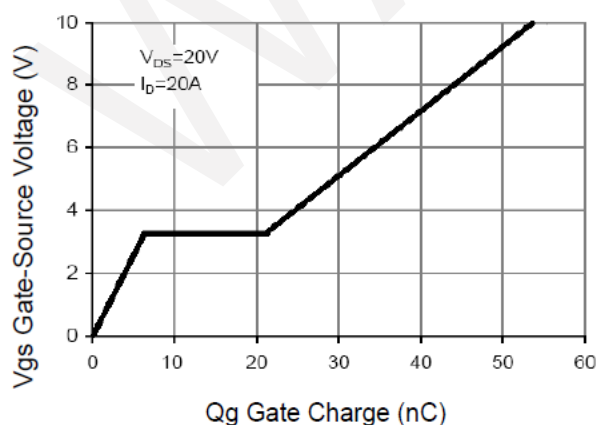
Transfer Characteristics



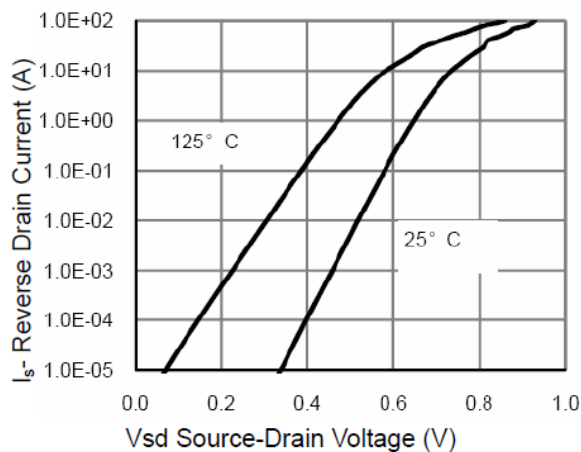
$R_{DS(on)}$ -Drain Current



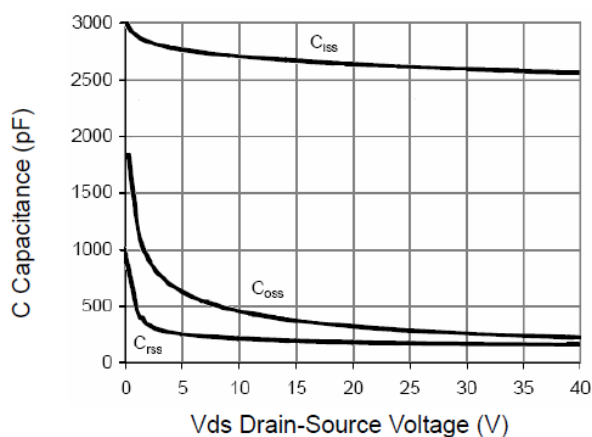
$R_{DS(on)}$ -Junction Temperature



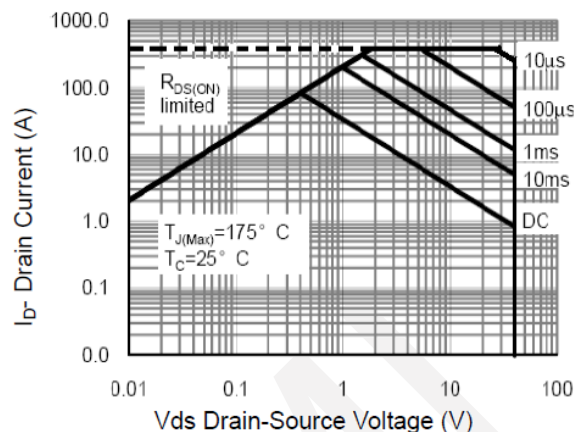
Gate Charge



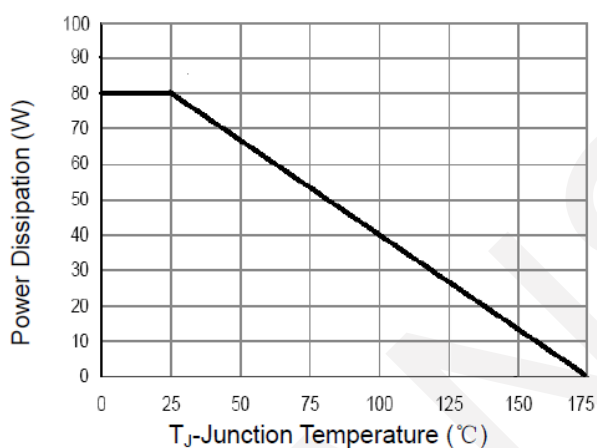
Source-Drain Diode Forward



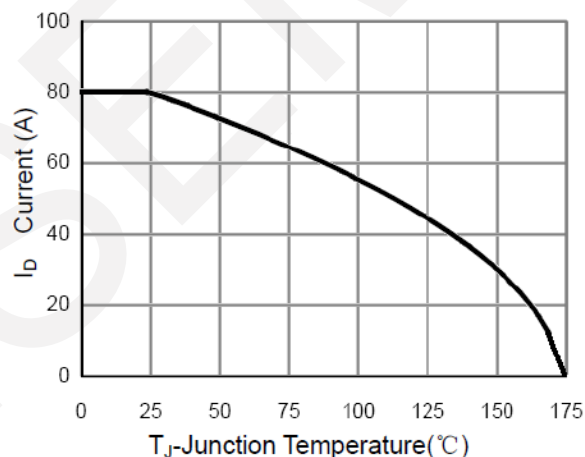
**Capacitance vs Vds**



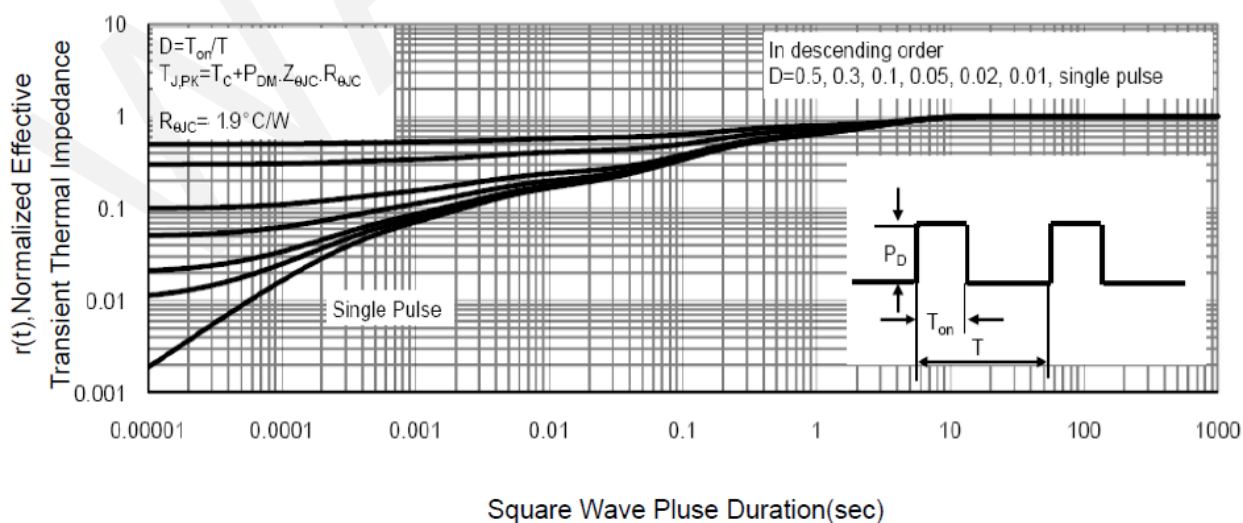
**Safe Operation Area**



**Power De-rating**

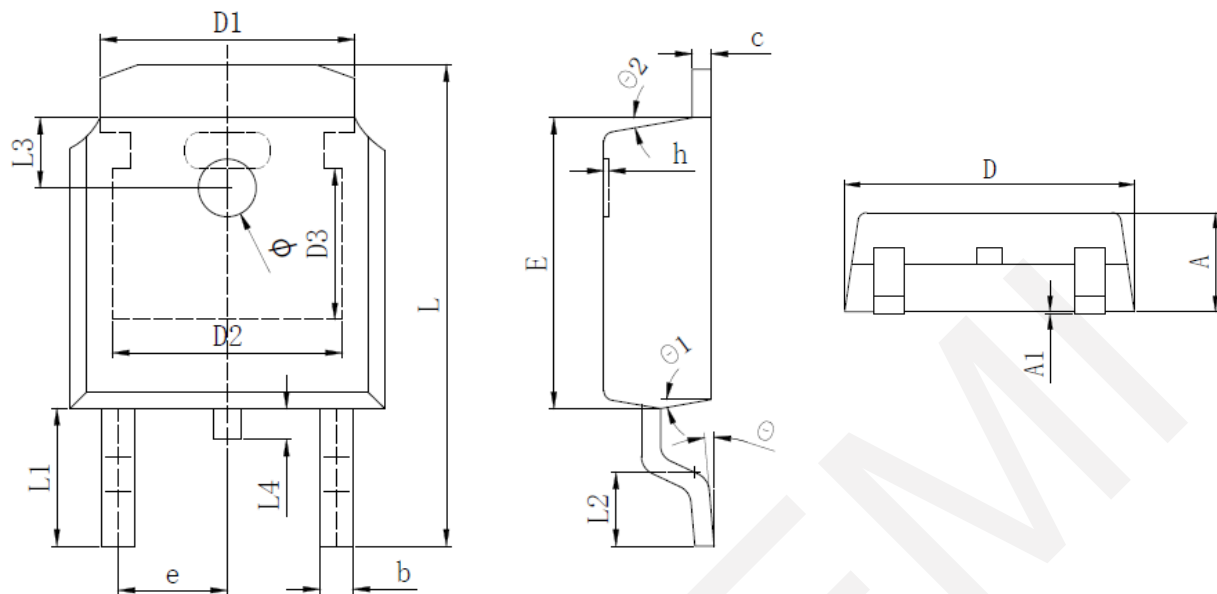


**ID Current vs. Junction Temperature**



**Normalized Maximum Transient Thermal Impedance**

## 8.Package Dimensions



| SYMBOL | MILLIMETER |        |        |
|--------|------------|--------|--------|
|        | MIN        | Typ.   | MAX    |
| A      | 2.200      | 2.300  | 2.400  |
| A1     | 0.000      |        | 0.127  |
| b      | 0.640      | 0.690  | 0.740  |
| c(电镀后) | 0.460      | 0.520  | 0.580  |
| D      | 6.500      | 6.600  | 6.700  |
| D1     | 5.334 REF  |        |        |
| D2     | 4.826 REF  |        |        |
| D3     | 3.166 REF  |        |        |
| E      | 6.000      | 6.100  | 6.200  |
| e      | 2.286 TYP  |        |        |
| h      | 0.000      | 0.100  | 0.200  |
| L      | 9.900      | 10.100 | 10.300 |
| L1     | 2.888 REF  |        |        |
| L2     | 1.400      | 1.550  | 1.700  |
| L3     | 1.600 REF  |        |        |
| L4     | 0.600      | 0.800  | 1.000  |
| φ      | 1.100      | 1.200  | 1.300  |
| θ      | 0°         |        | 8°     |
| θ 1    | 9° TYP     |        |        |
| θ 2    | 9° TYP     |        |        |

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