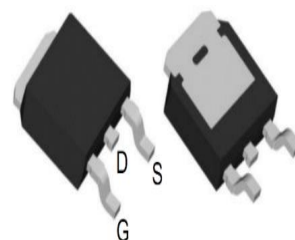


# 60V<sub>DS</sub>/±20V<sub>GS</sub> N-Channel Enhancement Mode MOSFET

## Features

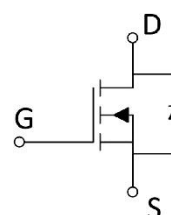
- $V_{DS}=60V, I_D=30A$
- $R_{DS(ON)}=18m\Omega$  (TYP.)  $V_{GS}=10V$
- $R_{DS(ON)}=30m\Omega$  (TYP.)  $V_{GS}=4.5V$
- Reliable and Rugged
- Avalanche Rated
- Low On-Resistance
- High Current Capability

TO-252



## Applications

- Load Switch
- Power management in portable/desktop PCs
- DC/DC conversion



## Ordering Information

| Device   | package | Device Marking | Package Qty. |
|----------|---------|----------------|--------------|
| FDD86581 | TO-252  | D86581         | 2500/PCS     |

## Absolute Maximum Ratings ( $T_C=25^{\circ}C$ , unless otherwise noted)

| Parameter                                       | Symbol         | Value   | Unit |
|-------------------------------------------------|----------------|---------|------|
| Drain-Source Voltage ( $V_{GS}=0V$ )            | $V_{DS}$       | 60      | V    |
| Gate-Source Voltage ( $V_{GS}=0V$ , static)     | $V_{GS}$       | ±20     | V    |
| Continuous Drain Current ( $T_C=25^{\circ}C$ )  | $I_D$          | 30      | A    |
| Continuous Drain Current ( $T_C=100^{\circ}C$ ) |                | 18      | A    |
| Pulsed Drain Current                            | $I_{DM}$       | 150     | A    |
| Maximum Power Dissipation                       | $P_D$          | 60      | W    |
| Maximum Power Dissipation                       |                | 0.4     | W/°C |
| Single pulse avalanche energy                   | $E_{AS}$       | 70      | mJ   |
| Operating, Storage Temperature Range            | $T_J, T_{STG}$ | -55~175 | °C   |

## Thermal Characteristics

| Parameter                            | Symbol          | Min. | Typ. | Max. | Unit   |
|--------------------------------------|-----------------|------|------|------|--------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | -    | 2.5  | -    | °C / W |

## Electrical Characteristics

| Parameter                        | Symbol       | Test Conditions               | Min. | Typ. | Max.      | Unit       |
|----------------------------------|--------------|-------------------------------|------|------|-----------|------------|
| Drain-Source Breakdown Voltage   | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$     | 60   | -    | -         | V          |
| Zero Gate Voltage Drain Current  | $I_{DSS}$    | $V_{DS}=30V, V_{GS}=0V$       | -    | -    | 1         | $\mu A$    |
| Gate -Source Leakage Current     | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$   | -    | -    | $\pm 100$ | nA         |
| Gate Threshold Voltage           | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1    | 1.6  | 3         | V          |
| Drain-Source On-stage Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=20A$         | -    | 12   | 20        | m $\Omega$ |
|                                  |              | $V_{GS}=4.5V, I_D=20A$        | -    | 20   | 30        |            |

## Dynamic Characteristics

| Parameter                    | Symbol       | Test Conditions                                                   | Min. | Typ. | Max. | Unit     |
|------------------------------|--------------|-------------------------------------------------------------------|------|------|------|----------|
| Input capacitance            | $C_{iss}$    | $V_{DS}=15V$<br>$V_{GS}=0V$<br>$f=1MHz$                           | -    | 1122 | -    | pF       |
| Output capacitance           | $C_{oss}$    |                                                                   | -    | 138  | -    |          |
| Reverse transfer capacitance | $C_{rss}$    |                                                                   | -    | 10   | -    |          |
| Gate Resistance              | $R_g$        | $f=1MHz$                                                          | -    | 1.5  | -    | $\Omega$ |
| Total Gate Charge            | $Q_g$        | $V_{DS}=15V$<br>$V_{GS}=10V$<br>$I_D=20A$                         | -    | 23   | -    | nC       |
| Gate Source Charge           | $Q_{gs}$     |                                                                   | -    | 7    | -    |          |
| Gate Drain Charge            | $Q_{gd}$     |                                                                   | -    | 4.5  | -    |          |
| Turn-on delay Time           | $t_{d(on)}$  | $V_{GS}=10V$<br>$V_{DS}=15V$<br>$R_L=0.75\Omega$<br>$R_G=3\Omega$ | -    | 10   | -    | ns       |
| Rise time                    | $t_r$        |                                                                   | -    | 8    | -    |          |
| Turn-off delay Time          | $t_{d(off)}$ |                                                                   | -    | 30   | -    |          |
| Fall time                    | $t_f$        |                                                                   | -    | 5    | -    |          |

## Reverse Diode Characteristics

| Parameter                  | Symbol   | Test Conditions                                 | Min. | Typ. | Max. | Unit |
|----------------------------|----------|-------------------------------------------------|------|------|------|------|
| Body Diode Forward Voltage | $V_{SD}$ | $V_{GS}=0V, I_{SD}=1A$                          | -    | 0.85 | 1.2  | V    |
| Reverse Recovery Time      | $t_{rr}$ | $V_{GS}=0V, I_{SD}=20A$<br>$d_i/d_t=500A/\mu s$ | -    | 22   | -    | ns   |
| Reverse Recovery Charge    | $Q_{rr}$ |                                                 | -    | 11   | -    | nC   |

## Electrical Characteristics Diagrames

Figure 1. On-Regin Characteristics

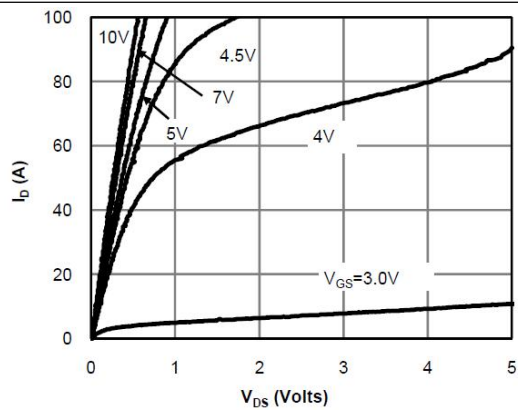


Figure 2. Transfer Characteristics

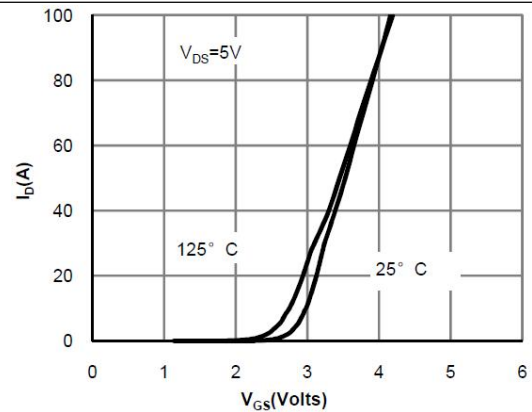


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

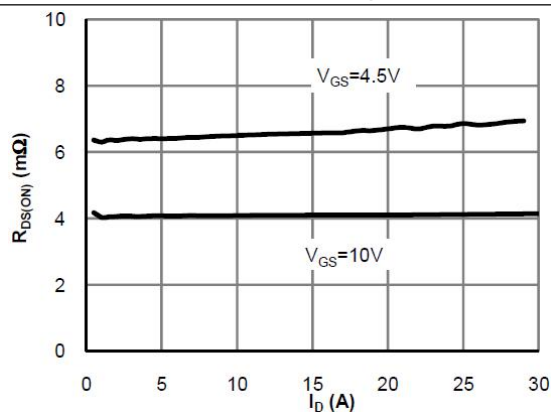


Figure 4. On-Resistance vs. Junction Temperature

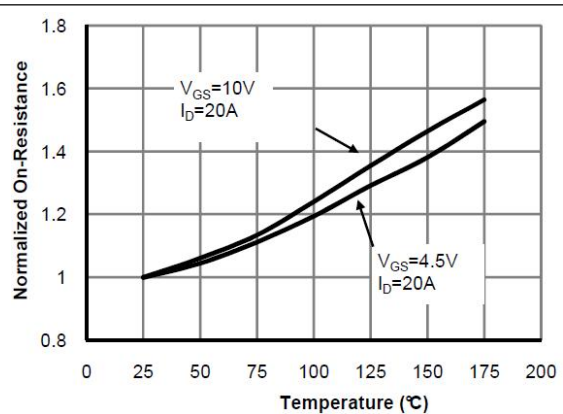


Figure 5. On-Resistance vs. Gate-Source Voltage

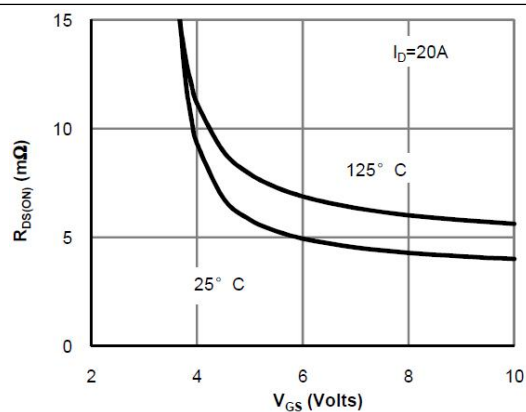
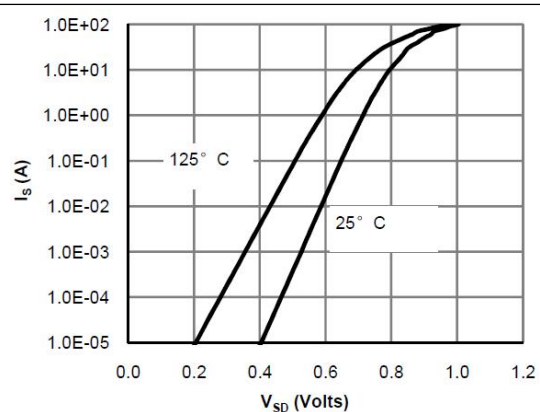
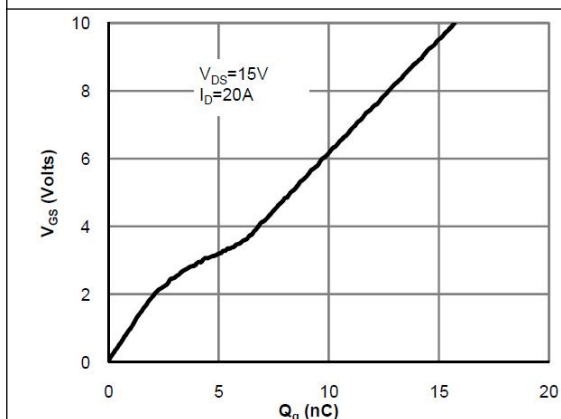


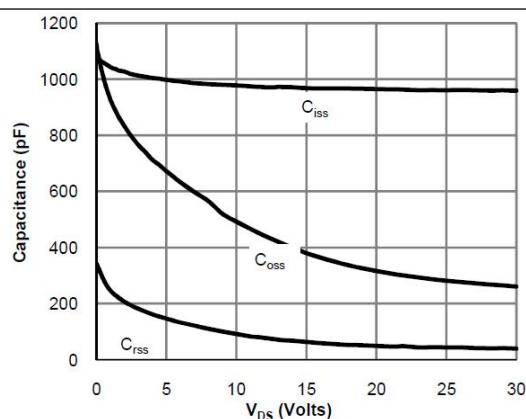
Figure 6. Body-Diode Characteristics



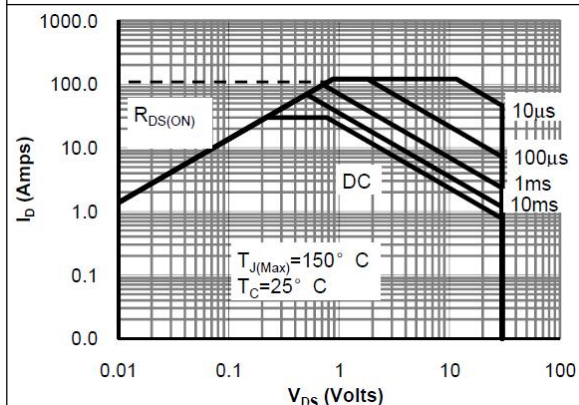
**Figure 7. Gate-Charge Characteristics**



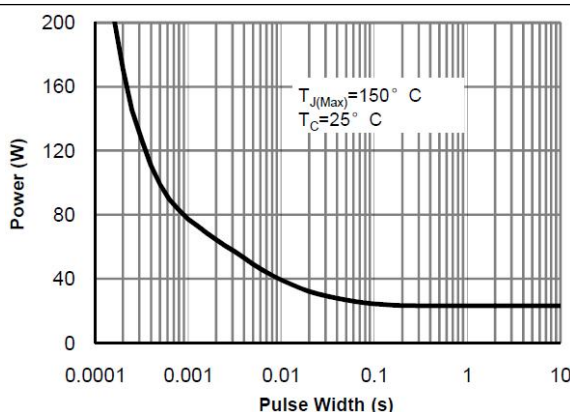
**Figure 8. Capacitance Characteristics**



**Figure 9. Maximum Forward Biased Safe Operating Area**



**Figure 10. Single Pulse Power Rating Junction-to-Case**



**Figure 11. Normalized Maximum Transient Thermal Impedance**

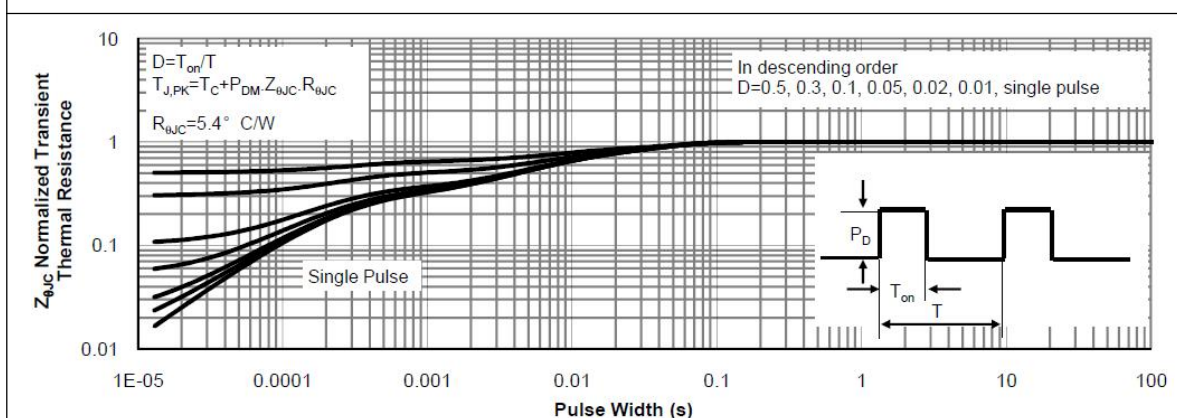


Figure 12. Power De-rating

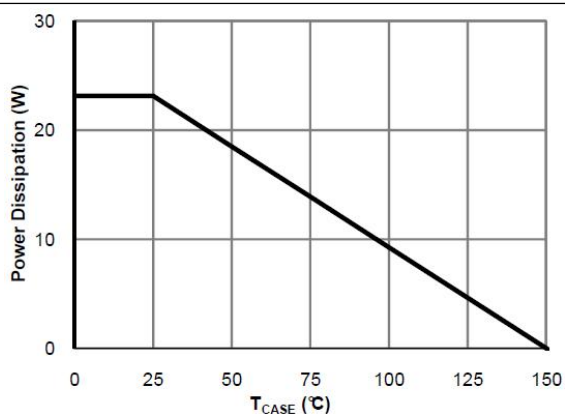


Figure 13. Current De-rating

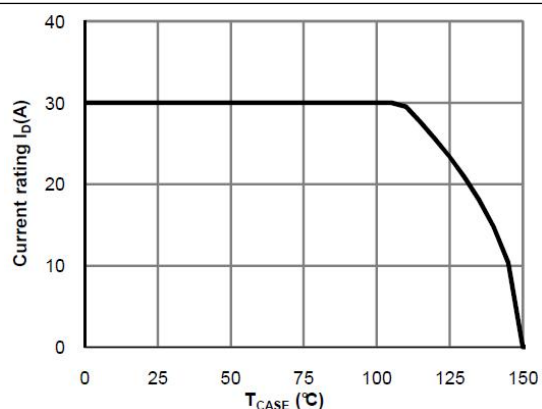


Figure 14. Single Pulse Power Rating Junction-to-Ambient

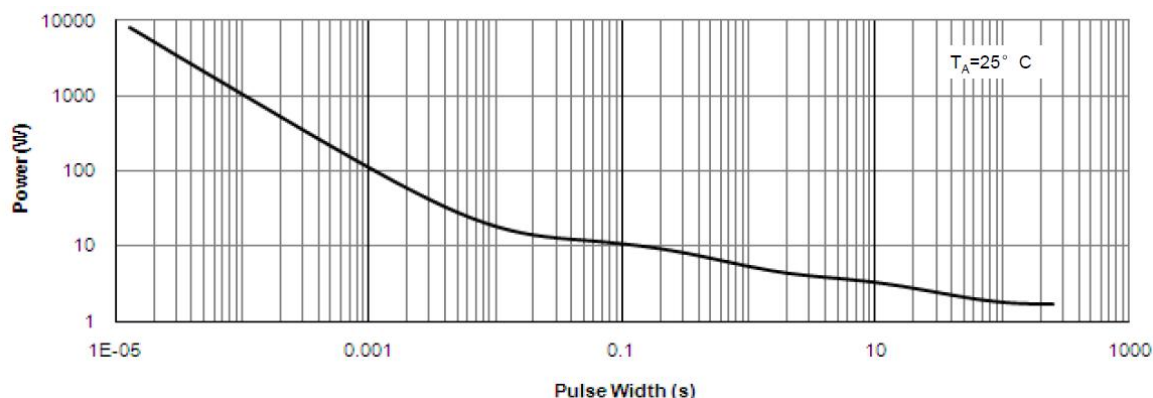
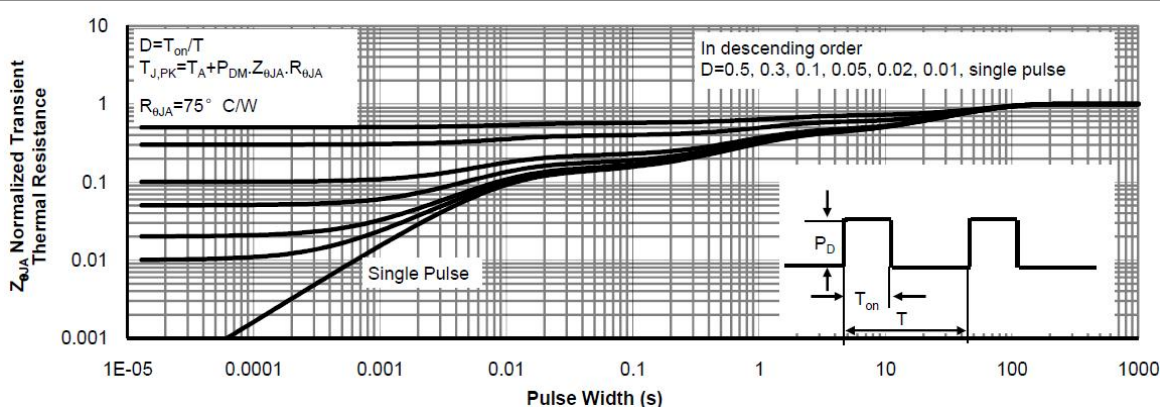
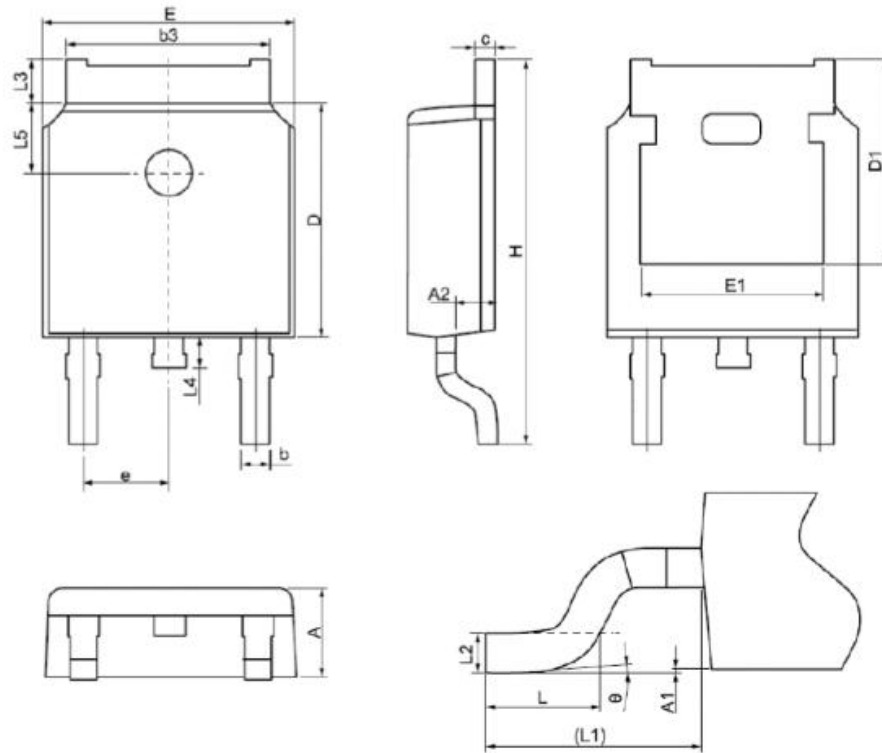


Figure 15. Normalized Maximum Transient Thermal Impedance



## Physical Dimensions

### TO-252



| Symbol | Dimension (mm) |      |      | Symbol | Dimension (mm) |       |       |
|--------|----------------|------|------|--------|----------------|-------|-------|
|        | Min            | Nom  | Max  |        | Min            | Nom   | Max   |
| A      | 2.20           | 2.30 | 2.40 | e      | 2.286(BSC)     |       |       |
| A1     | 0.00           | -    | 0.20 | H      | 9.40           | 10.10 | 10.50 |
| A2     | 0.97           | 1.07 | 1.17 | L      | 1.38           | 1.50  | 1.75  |
| b      | 0.68           | 0.78 | 0.90 | L1     | 2.90(REF)      |       |       |
| b3     | 5.20           | 5.33 | 5.50 | L2     | 0.51(BSC)      |       |       |
| c      | 0.43           | 0.53 | 0.63 | L3     | 0.88           | -     | 1.28  |
| D      | 5.98           | 6.10 | 6.22 | L4     | 0.50           | -     | 1.00  |
| D1     | 5.30(REF)      |      |      | L5     | 1.65           | 1.80  | 1.95  |
| E      | 6.40           | 6.60 | 6.80 | θ      | 0°             | -     | 8°    |
| E1     | 4.63           | -    | -    | -      | -              | -     | -     |

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