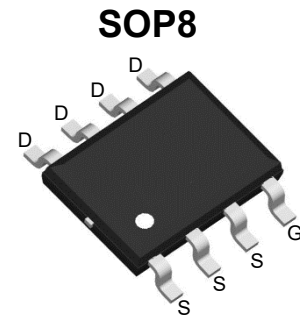


## -40V<sub>DS</sub>/13A P-Channel Advanced Mode MOSFET

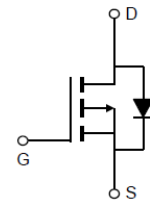
### Features

- $V_{DS}=-40V, I_D=-13A$
- $R_{DS(ON)}=10m\Omega$  (TYP.)  $V_{GS}=-10V$
- $R_{DS(ON)}=16m\Omega$  (TYP.)  $V_{GS}=-4.5V$
- Fast Switching
- Low On-Resistance



### Applications

- Switch switching
- Power management in portable/desktop PCs



### Ordering Information

| Device   | package | Device Marking | Package Qty. |
|----------|---------|----------------|--------------|
| HAM40P13 | SOP-8   | M40P13         | 3000/PCS     |

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

| Parameter                                       | Symbol         | Value    | Unit        |
|-------------------------------------------------|----------------|----------|-------------|
| Drain-Source Voltage ( $V_{GS}=0V$ )            | $V_{DS}$       | -40      | V           |
| Gate-Source Voltage ( $V_{GS}=0V$ , static)     | $V_{GS}$       | $\pm 20$ | V           |
| Continuous Drain Current ( $T_a=25^{\circ}C$ )  | $I_D$          | -13      | A           |
| Continuous Drain Current ( $T_a=70^{\circ}C$ )  |                | -11      | A           |
| Pulesd Drain Current                            | $I_{DM}$       | -50      | A           |
| Avalanche Energy, Single Pulsed                 | $E_{AS}$       | 121      | mJ          |
| Maximum Power Dissipation ( $T_a=25^{\circ}C$ ) | $P_D$          | 2        | W           |
| Maximum Power Dissipation ( $T_a=70^{\circ}C$ ) |                | 0.8      | W           |
| Operating, Storage Temperature Range            | $T_J, T_{STG}$ | -55~150  | $^{\circ}C$ |

### Thermal Characteristics

| Parameter                               | Symbol          | Min. | Typ. | Max. | Unit          |
|-----------------------------------------|-----------------|------|------|------|---------------|
| Thermal Resistance, Junction-to-Case    | $R_{\theta JC}$ | -    | 16   | -    | $^{\circ}C/W$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | -    | 59   | -    | $^{\circ}C/W$ |

## Electrical Characteristics

| Parameter                        | Symbol       | Test Conditions                | Min. | Typ. | Max.      | Unit       |
|----------------------------------|--------------|--------------------------------|------|------|-----------|------------|
| Drain-Source Breakdown Voltage   | $BV_{DSS}$   | $V_{GS}=0V, I_D=-250\mu A$     | -40  | -    | -         | 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           | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=-250\mu A$ | -0.8 | -1   | -1.2      | V          |
| Drain-Source On-stage Resistance | $R_{DS(on)}$ | $V_{GS}=-10V, I_D=-1A$         | -    | 10   | 15        | m $\Omega$ |
|                                  |              | $V_{GS}=-4.5V, I_D=-1A$        | -    | 16   | 21        |            |

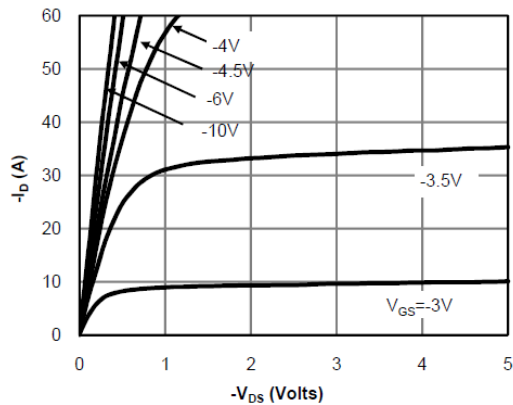
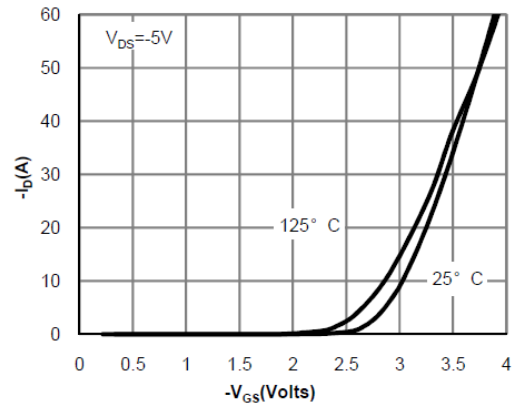
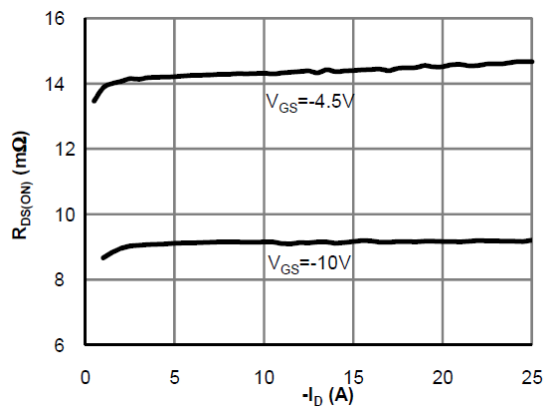
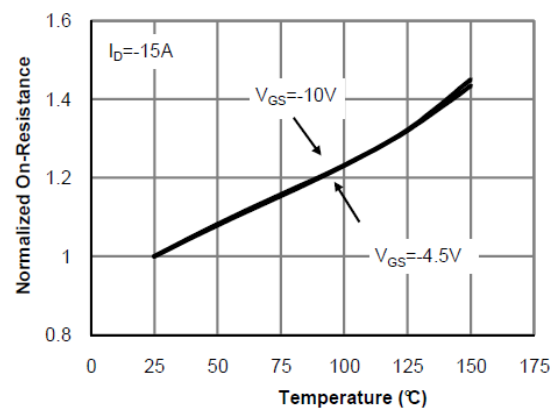
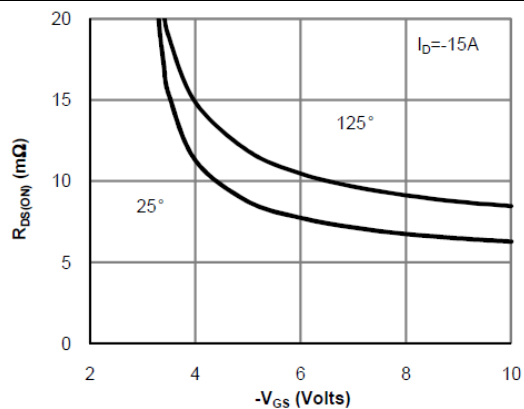
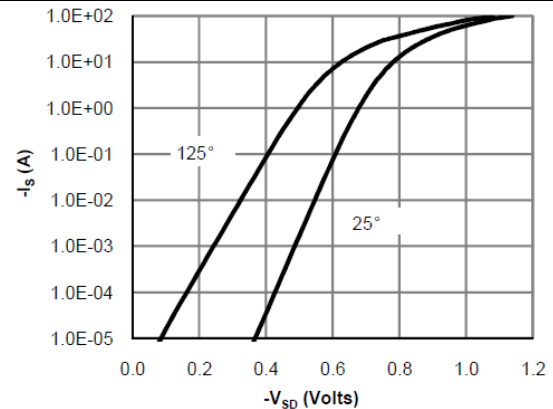
## Dynamic Characteristics

| Parameter                    | Symbol       | Test Conditions                                                  | Min. | Typ. | Max. | Unit     |
|------------------------------|--------------|------------------------------------------------------------------|------|------|------|----------|
| Input capacitance            | $C_{iss}$    | $V_{DS}=-15V$<br>$V_{GS}=0V$<br>$f=1MHz$                         | -    | 2757 | -    | pF       |
| Output capacitance           | $C_{oss}$    |                                                                  | -    | 240  | -    |          |
| Reverse transfer capacitance | $C_{rss}$    |                                                                  | -    | 137  | -    |          |
| Gate Resistance              | $R_g$        | $f=1MHz$                                                         | -    | 2.4  | -    | $\Omega$ |
| Total Gate Charge            | $Q_g$        | $V_{DS}=-15V$<br>$V_{GS}=-10V$<br>$I_D=-15A$                     | -    | 46   | -    | nC       |
| Gate Source Charge           | $Q_{gs}$     |                                                                  | -    | 15.5 | -    |          |
| Gate Drain Charge            | $Q_{gd}$     |                                                                  | -    | 18   | -    |          |
| Turn-on delay Time           | $t_{d(on)}$  | $V_{GS}=-10V$<br>$V_{DS}=-15V$<br>$R_L=1\Omega$<br>$R_G=3\Omega$ | -    | 15   | -    | ns       |
| Rise time                    | $t_r$        |                                                                  | -    | 17   | -    |          |
| Turn-off delay Time          | $t_{d(off)}$ |                                                                  | -    | 68   | -    |          |
| Fall time                    | $t_f$        |                                                                  | -    | 39   | -    |          |

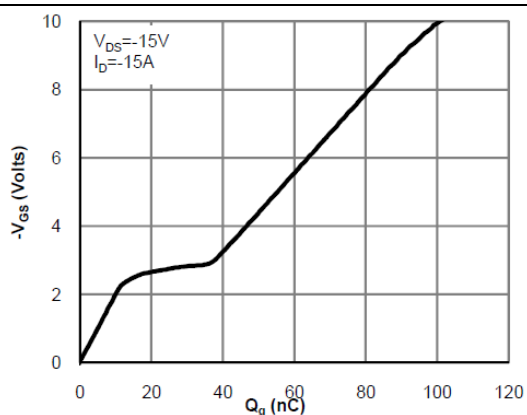
## Reverse Diode Characteristics

| Parameter                  | Symbol   | Test Conditions                                  | Min. | Typ.  | Max. | Unit |
|----------------------------|----------|--------------------------------------------------|------|-------|------|------|
| Body Diode Forward Voltage | $V_{SD}$ | $V_{GS}=0V, I_{SD}=-1A$                          | -    | -0.75 | -1   | V    |
| Reverse Recovery Time      | $t_{rr}$ | $V_{GS}=0V, I_{SD}=-15A$<br>$d_i/d_t=100A/\mu s$ | -    | 37    | -    | ns   |
| Reverse Recovery Charge    | $Q_{rr}$ |                                                  | -    | 25    | -    | nC   |

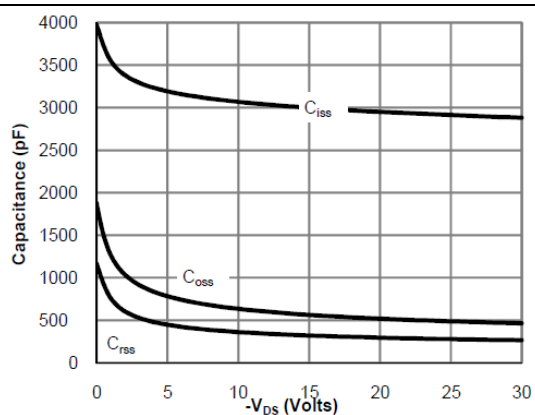
## Electrical Characteristics Diagrames

**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**


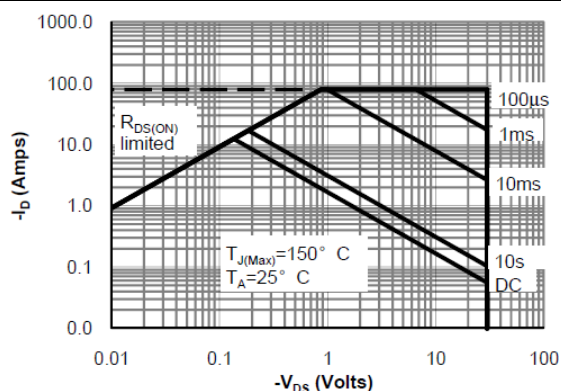
**Figure 7. Gate-Charge Characteristics**



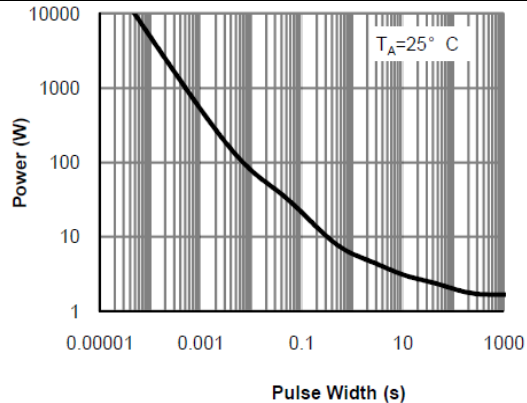
**Figure 8. Capacitance Characteristics**



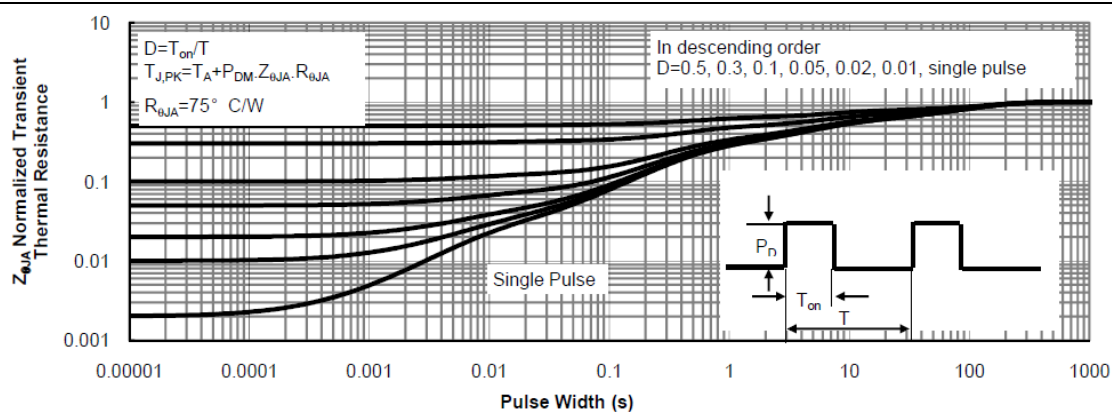
**Figure 9. Maximum Forward Biased Safe Operating Area**



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

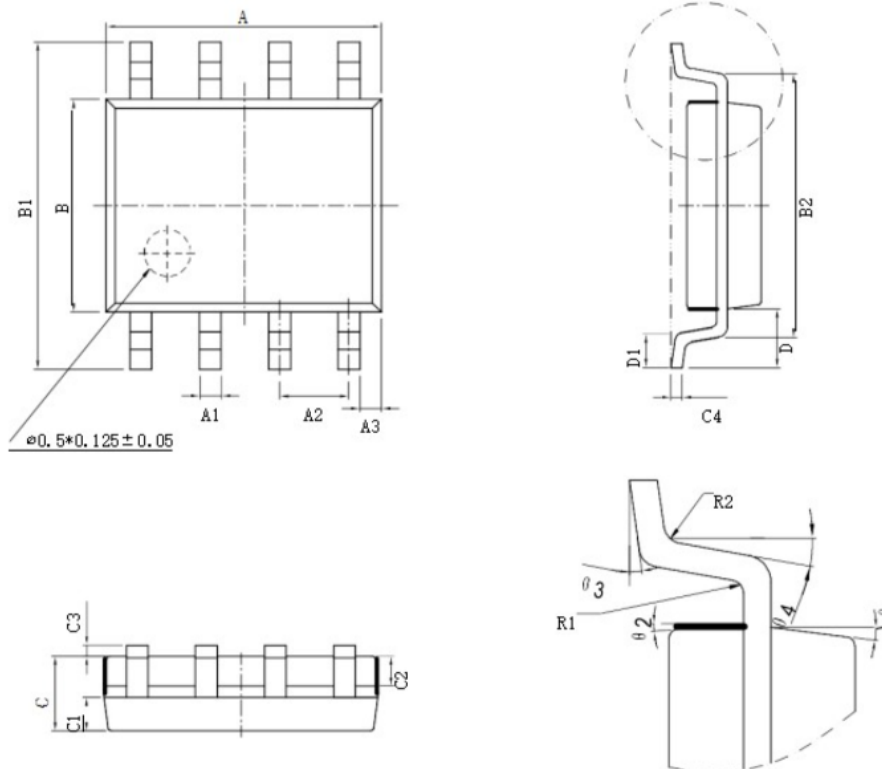


**Figure 11. Normalized Maximum Transient Thermal Impedance**



## Physical Dimensions

### SOP8



| 符号 | 尺寸 (mm)   |       | 符号 | 尺寸 (mm)  |       |
|----|-----------|-------|----|----------|-------|
|    | 最小值       | 最大值   |    | 最小值      | 最大值   |
| A  | 4.80      | 5.00  | C3 | 0.05     | 0.20  |
| A1 | 0.356     | 0.456 | C4 | 0.203    | 0.233 |
| A2 | 1.27 TYP  |       | D  | 1.05 TYP |       |
| A3 | 0.345 TYP |       | D1 | 0.40     | 0.80  |
| B  | 3.80      | 4.00  | R1 | 0.20 TYP |       |
| B1 | 5.80      | 6.20  | R2 | 0.20 TYP |       |
| B2 | 5.00 TYP  |       | θ1 | 17° TYP4 |       |
| C  | 1.30      | 1.60  | θ2 | 13° TYP4 |       |
| C1 | 0.55      | 0.65  | θ3 | 0° ~ 8°  |       |
| C2 | 0.55      | 0.65  | θ4 | 4° ~ 12° |       |

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