

## P-Ch 20V Fast Switching MOSFETs

- ★ 100% EAS Guaranteed
- ★ Super Low Gate Charge
- ★ Green Device Available
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology

### Product Summary



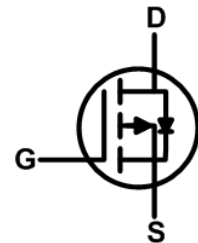
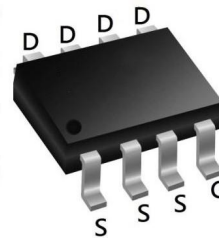
| BVDSS | RDSON | ID   |
|-------|-------|------|
| -20V  | 12mΩ  | -20A |

### Description

The UD20P02S is the high cell density trench P-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The UD20P02S meet the RoHS and Green Product requirement 100% EAS guaranteed with full function reliability approved.

### SOP8 Pin Configuration



### Absolute Maximum Ratings

| Symbol               | Parameter                                    | Rating     | Units      |
|----------------------|----------------------------------------------|------------|------------|
| $V_{DS}$             | Drain-Source Voltage                         | -20        | V          |
| $V_{GS}$             | Gate-Source Voltage                          | $\pm 12$   | V          |
| $I_D@T_C=25^\circ C$ | Continuous Drain Current, $V_{GS} @ -4.5V^1$ | -20        | A          |
| $I_D@T_C=70^\circ C$ | Continuous Drain Current, $V_{GS} @ -4.5V^1$ | -10        | A          |
| $I_{DM}$             | Pulsed Drain Current <sup>2</sup>            | -68        | A          |
| $P_D@T_C=25^\circ C$ | Total Power Dissipation <sup>3</sup>         | 38         | W          |
| $P_D@T_C=70^\circ C$ | Total Power Dissipation <sup>3</sup>         | 18         | W          |
| $T_{STG}$            | Storage Temperature Range                    | -55 to 150 | $^\circ C$ |
| $T_J$                | Operating Junction Temperature Range         | -55 to 150 | $^\circ C$ |

### Thermal Data

| Symbol          | Parameter                                                  | Max. | Unit         |
|-----------------|------------------------------------------------------------|------|--------------|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient <sup>1</sup>           | 75   | $^\circ C/W$ |
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient <sup>1</sup> (t ≤ 10s) | 40   | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case <sup>1</sup>              | 4.2  | $^\circ C/W$ |

**P-Ch 20V Fast Switching MOSFETs**
**Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)**

| Symbol                       | Parameter                                      | Conditions                                                       | Min. | Typ.   | Max.      | Unit                 |
|------------------------------|------------------------------------------------|------------------------------------------------------------------|------|--------|-----------|----------------------|
| $BV_{DSS}$                   | Drain-Source Breakdown Voltage                 | $V_{GS}=0V$ , $I_D=-250\mu A$                                    | -20  | ---    | ---       | V                    |
| $\Delta BV_{DSS}/\Delta T_J$ | $BV_{DSS}$ Temperature Coefficient             | Reference to $25^\circ\text{C}$ , $I_D=-1mA$                     | ---  | -0.012 | ---       | V/ $^\circ\text{C}$  |
| $R_{DS(ON)}$                 | Static Drain-Source On-Resistance <sup>2</sup> | $V_{GS}=-4.5V$ , $I_D=-10A$                                      | ---  | 12     | 15        | $m\Omega$            |
|                              |                                                | $V_{GS}=-2.5V$ , $I_D=-8A$                                       | ---  | 15     | 19        |                      |
|                              |                                                |                                                                  |      |        |           |                      |
| $V_{GS(th)}$                 | Gate Threshold Voltage                         | $V_{GS}=V_{DS}$ , $I_D=-250\mu A$                                | -0.4 | -0.7   | -1.0      | V                    |
| $\Delta V_{GS(th)}$          | $V_{GS(th)}$ Temperature Coefficient           |                                                                  | ---  | 2.94   | ---       | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                    | Drain-Source Leakage Current                   | $V_{DS}=-15V$ , $V_{GS}=0V$ , $T_J=25^\circ\text{C}$             | ---  | ---    | 1         | $\mu A$              |
| $I_{GSS}$                    | Gate-Source Leakage Current                    | $V_{GS}=\pm 12V$ , $V_{DS}=0V$                                   | ---  | ---    | $\pm 100$ | nA                   |
| $g_{fs}$                     | Forward Transconductance                       | $V_{DS}=-5V$ , $I_D=-10A$                                        | ---  | 43     | ---       | S                    |
| $Q_g$                        | Total Gate Charge (-4.5V)                      | $V_{DS}=-10V$ , $V_{GS}=-4.5V$ , $I_D=-10A$                      | ---  | 35     | ---       | nC                   |
| $Q_{gs}$                     | Gate-Source Charge                             |                                                                  | ---  | 5.0    | ---       |                      |
| $Q_{gd}$                     | Gate-Drain Charge                              |                                                                  | ---  | 10     | ---       |                      |
| $T_{d(on)}$                  | Turn-On Delay Time                             | $V_{DD}=-10V$ , $V_{GS}=-4.5V$ ,<br>$R_G=3.3\Omega$ , $I_D=-10A$ | ---  | 12.0   | ---       | ns                   |
| $T_r$                        | Rise Time                                      |                                                                  | ---  | 40.0   | ---       |                      |
| $T_{d(off)}$                 | Turn-Off Delay Time                            |                                                                  | ---  | 30     | ---       |                      |
| $T_f$                        | Fall Time                                      |                                                                  | ---  | 10     | ---       |                      |
| $C_{iss}$                    | Input Capacitance                              | $V_{DS}=-15V$ , $V_{GS}=0V$ , $f=1MHz$                           | ---  | 2800   | ---       | pF                   |
| $C_{oss}$                    | Output Capacitance                             |                                                                  | ---  | 690    | ---       |                      |
| $C_{rss}$                    | Reverse Transfer Capacitance                   |                                                                  | ---  | 590    | ---       |                      |

**Diode Characteristics**

| Symbol   | Parameter                                | Conditions                                                  | Min. | Typ. | Max.  | Unit |
|----------|------------------------------------------|-------------------------------------------------------------|------|------|-------|------|
| $I_S$    | Continuous Source Current <sup>1,4</sup> | $V_G=V_D=0V$ , Force Current                                | ---  | ---  | -20.0 | A    |
| $I_{SM}$ | Pulsed Source Current <sup>2,4</sup>     |                                                             | ---  | ---  | ---   | A    |
| $V_{SD}$ | Diode Forward Voltage <sup>2</sup>       | $V_{GS}=0V$ , $I_S=-1A$ , $T_J=25^\circ\text{C}$            | ---  | ---  | -1.2  | V    |
| $t_{rr}$ | Reverse Recovery Time                    | $I_F=-10A$ , $dI/dt=100A/\mu s$ ,<br>$T_J=25^\circ\text{C}$ | ---  | 27   | ---   | nS   |
| $Q_{rr}$ | Reverse Recovery Charge                  |                                                             | ---  | 17.8 | ---   | nC   |

Note :

1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.
2. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
3. The power dissipation is limited by  $150^\circ\text{C}$  junction temperature
4. The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications, should be limited by total power dissipation.

### Typical Characteristics

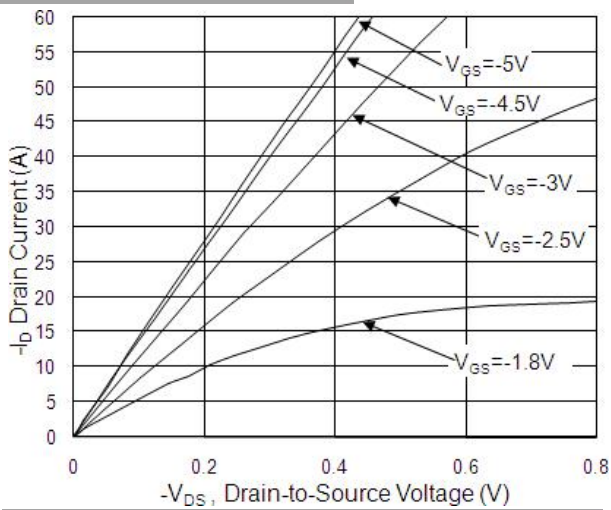


Fig.1 Typical Output Characteristics

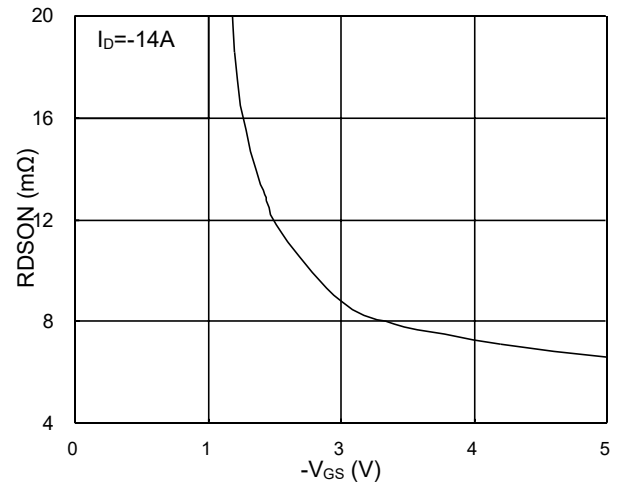


Fig.2 On-Resistance vs. G-S Voltage

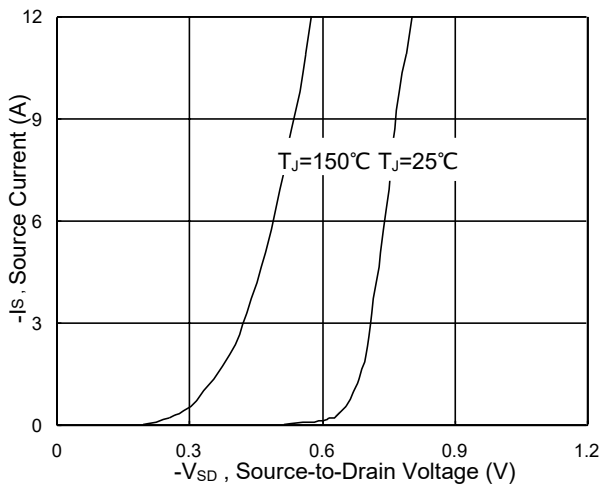


Fig.3 Forward Characteristics of Reverse

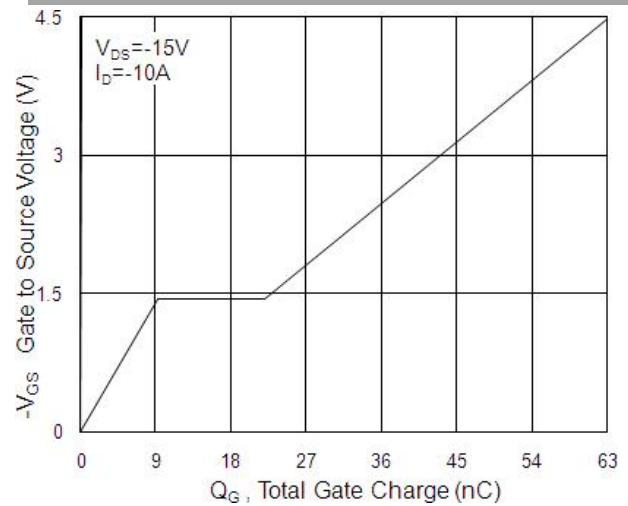


Fig.4 Gate-charge Characteristics

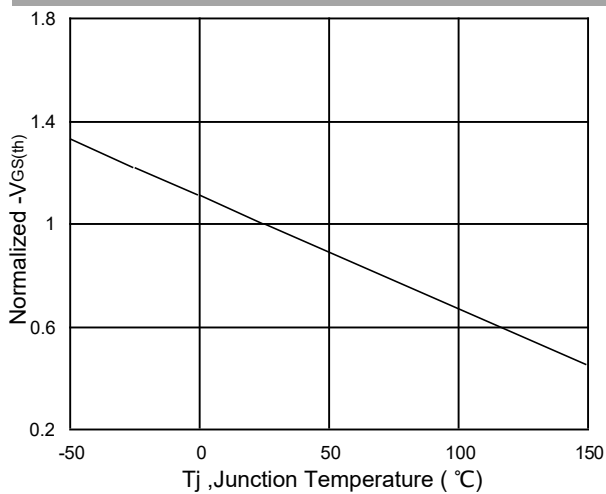


Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$

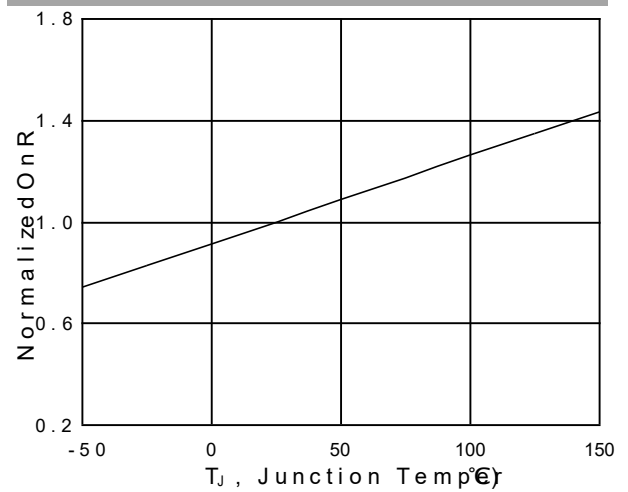


Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$

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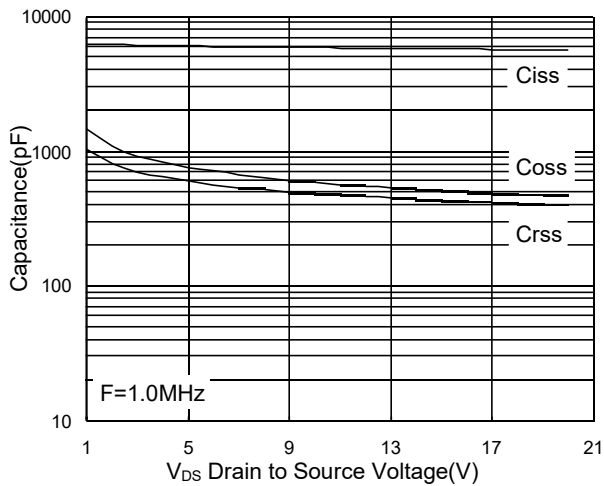


Fig.7 Capacitance

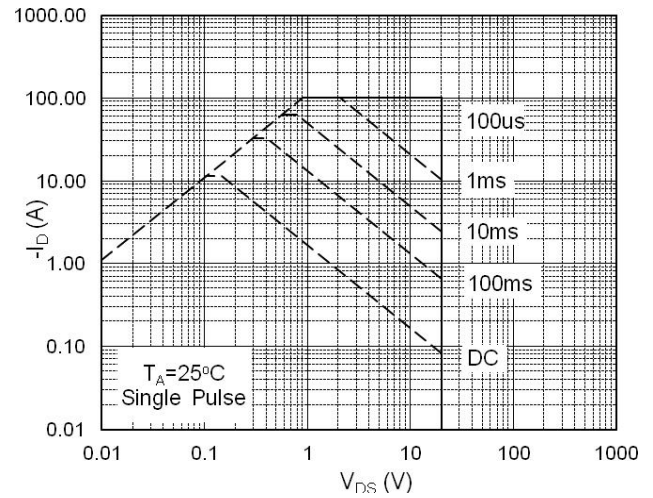


Fig.8 Safe Operating Area

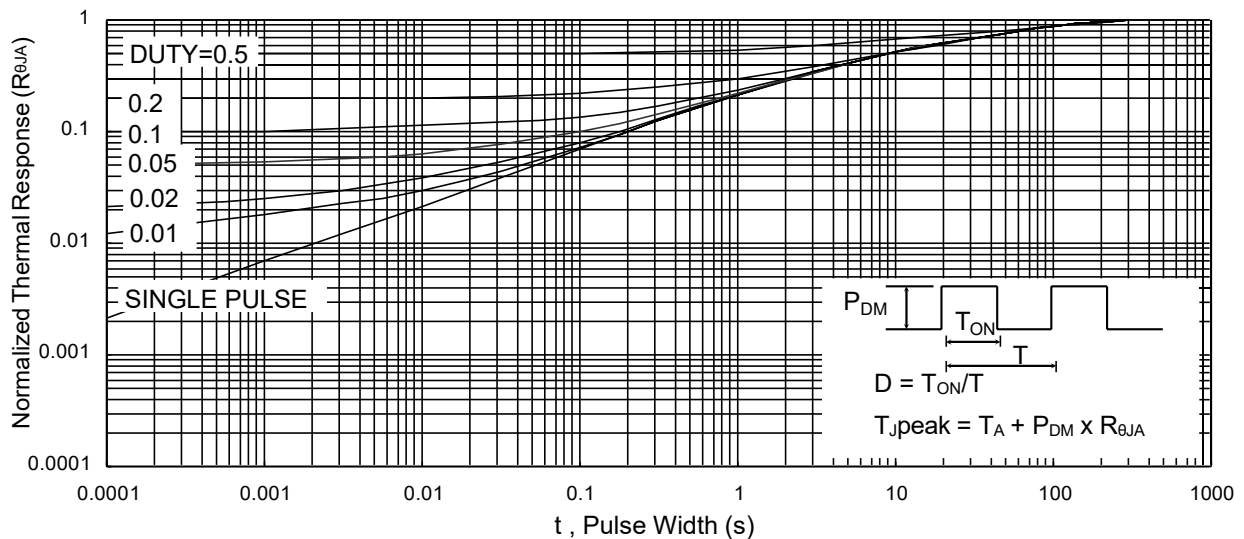


Fig.9 Normalized Maximum Transient Thermal Impedance

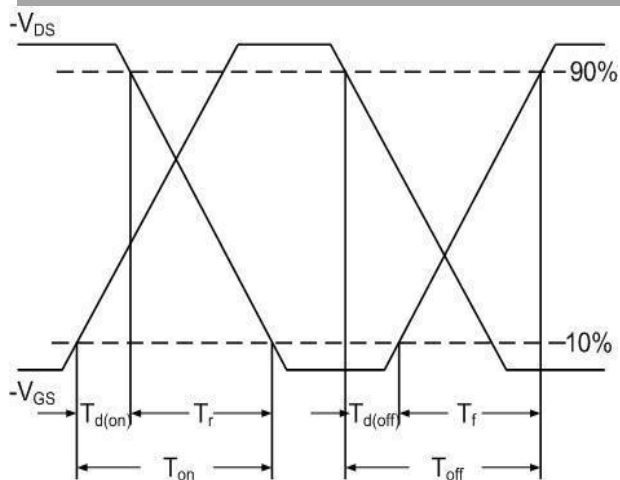


Fig.10 Switching Time Waveform

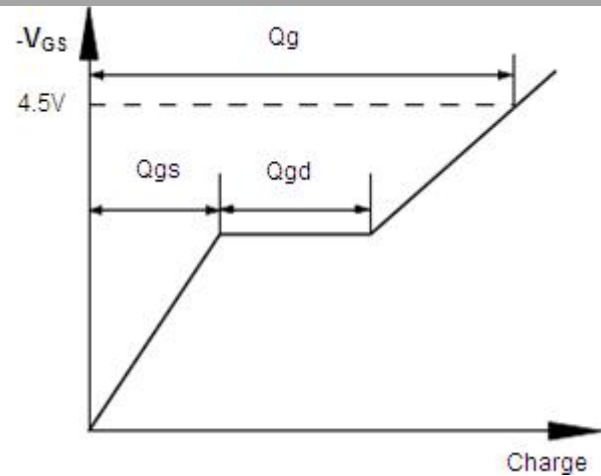
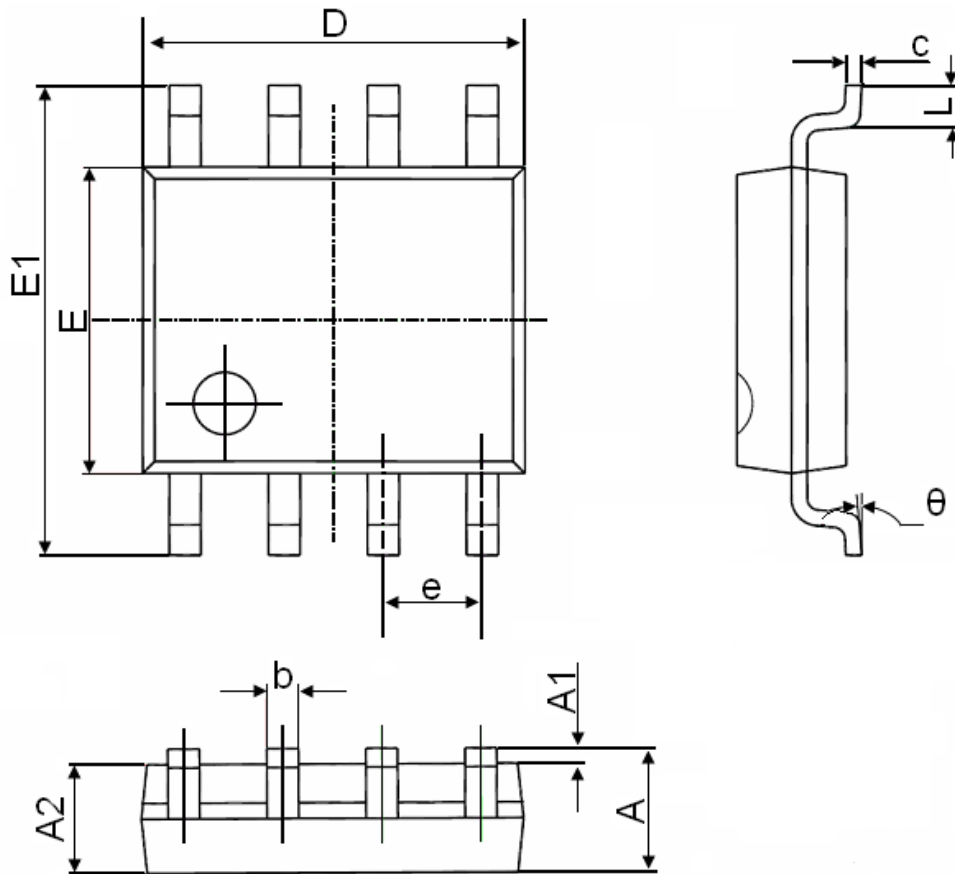


Fig.11 Gate Charge Waveform

## SOP-8 Package Information



| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min.                      | Max.  | Min.                 | Max.  |
| A        | 1.350                     | 1.750 | 0.053                | 0.069 |
| A1       | 0.100                     | 0.250 | 0.004                | 0.010 |
| A2       | 1.350                     | 1.550 | 0.053                | 0.061 |
| b        | 0.330                     | 0.510 | 0.013                | 0.020 |
| c        | 0.170                     | 0.250 | 0.006                | 0.010 |
| D        | 4.700                     | 5.100 | 0.185                | 0.200 |
| E        | 3.800                     | 4.000 | 0.150                | 0.157 |
| E1       | 5.800                     | 6.200 | 0.228                | 0.244 |
| e        | 1.270(BSC)                |       | 0.050(BSC)           |       |
| L        | 0.400                     | 1.270 | 0.016                | 0.050 |
| $\theta$ | 0°                        | 8°    | 0°                   | 8°    |