

# FS40SM-5

HIGH-SPEED SWITCHING USE

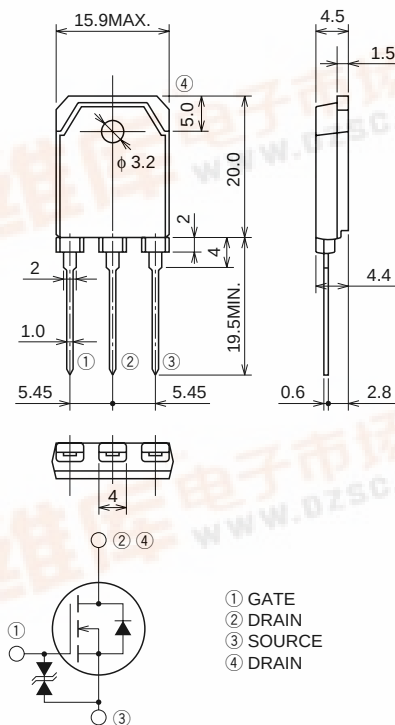
## FS40SM-5



- $V_{DS}$  ..... 250V
- $r_{DS(ON)}(MAX)$  .....  $0.086\Omega$
- $I_D$  ..... 40A

## OUTLINE DRAWING

Dimensions in mm



TO-3P

## APPLICATION

SMPS, DC-DC Converter, battery charger, power supply of printer, copier, HDD, FDD, TV, VCR, personal computer etc.

## MAXIMUM RATINGS (Tc = 25°C)

| Symbol    | Parameter                 | Conditions    | Ratings         | Unit |
|-----------|---------------------------|---------------|-----------------|------|
| $V_{DS}$  | Drain-source voltage      | $V_{GS} = 0V$ | 250             | V    |
| $V_{GS}$  | Gate-source voltage       | $V_{DS} = 0V$ | $\pm 30$        | V    |
| $I_D$     | Drain current             |               | 40              | A    |
| $I_{DM}$  | Drain current (Pulsed)    |               | 120             | A    |
| $P_D$     | Maximum power dissipation |               | 275             | W    |
| $T_{ch}$  | Channel temperature       |               | $-55 \sim +150$ | °C   |
| $T_{stg}$ | Storage temperature       |               | $-55 \sim +150$ | °C   |
| —         | Weight                    | Typical value | 4.8             | g    |

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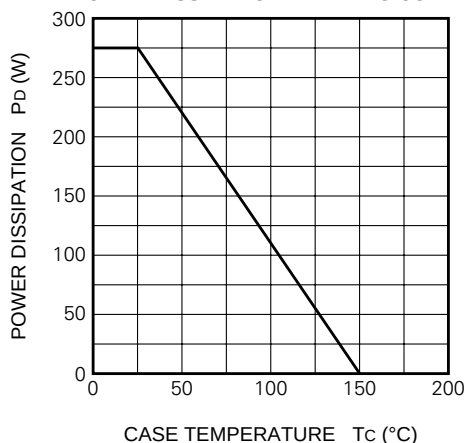
## HIGH-SPEED SWITCHING USE

### ELECTRICAL CHARACTERISTICS (T<sub>ch</sub> = 25°C)

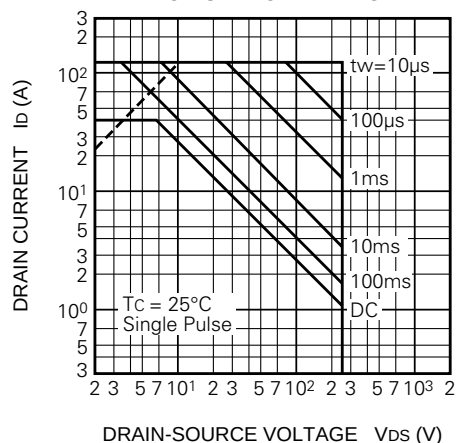
| Symbol                | Parameter                        | Test conditions                                                                                               | Limits |       |       | Unit |
|-----------------------|----------------------------------|---------------------------------------------------------------------------------------------------------------|--------|-------|-------|------|
|                       |                                  |                                                                                                               | Min.   | Typ.  | Max.  |      |
| V <sub>(BR)DSS</sub>  | Drain-source breakdown voltage   | I <sub>D</sub> = 1mA, V <sub>GS</sub> = 0V                                                                    | 250    | —     | —     | V    |
| V <sub>(BR)GSS</sub>  | Gate-source breakdown voltage    | I <sub>G</sub> = ±100μA, V <sub>DS</sub> = 0V                                                                 | ±30    | —     | —     | V    |
| I <sub>GSS</sub>      | Gate-source leakage current      | V <sub>GS</sub> = ±25V, V <sub>DS</sub> = 0V                                                                  | —      | —     | ±10   | μA   |
| I <sub>DSS</sub>      | Drain-source leakage current     | V <sub>DS</sub> = 250V, V <sub>GS</sub> = 0V                                                                  | —      | —     | 1     | mA   |
| V <sub>GS(th)</sub>   | Gate-source threshold voltage    | I <sub>D</sub> = 1mA, V <sub>DS</sub> = 10V                                                                   | 2      | 3     | 4     | V    |
| r <sub>DS(ON)</sub>   | Drain-source on-state resistance | I <sub>D</sub> = 20A, V <sub>GS</sub> = 10V                                                                   | —      | 0.066 | 0.086 | Ω    |
| V <sub>DS(ON)</sub>   | Drain-source on-state voltage    | I <sub>D</sub> = 20A, V <sub>GS</sub> = 10V                                                                   | —      | 1.32  | 1.72  | V    |
| y <sub>fs</sub>       | Forward transfer admittance      | I <sub>D</sub> = 20A, V <sub>DS</sub> = 10V                                                                   | 12.0   | 18.0  | —     | S    |
| C <sub>iss</sub>      | Input capacitance                | V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1MHz                                                         | —      | 2850  | —     | pF   |
| C <sub>oss</sub>      | Output capacitance               |                                                                                                               | —      | 580   | —     | pF   |
| C <sub>rss</sub>      | Reverse transfer capacitance     |                                                                                                               | —      | 110   | —     | pF   |
| t <sub>d(on)</sub>    | Turn-on delay time               | V <sub>DD</sub> = 150V, I <sub>D</sub> = 20A, V <sub>GS</sub> = 10V, R <sub>GEN</sub> = R <sub>GS</sub> = 50Ω | —      | 45    | —     | ns   |
| t <sub>r</sub>        | Rise time                        |                                                                                                               | —      | 125   | —     | ns   |
| t <sub>d(off)</sub>   | Turn-off delay time              |                                                                                                               | —      | 310   | —     | ns   |
| t <sub>f</sub>        | Fall time                        |                                                                                                               | —      | 140   | —     | ns   |
| V <sub>SD</sub>       | Source-drain voltage             | I <sub>S</sub> = 20A, V <sub>GS</sub> = 0V                                                                    | —      | 1.5   | 2.0   | V    |
| R <sub>th(ch-c)</sub> | Thermal resistance               | Channel to case                                                                                               | —      | —     | 0.45  | °C/W |

### PERFORMANCE CURVES

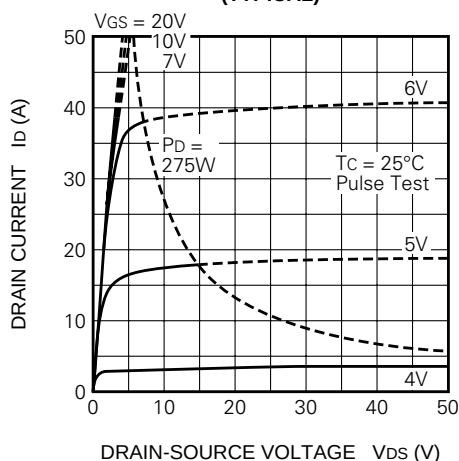
POWER DISSIPATION DERATING CURVE



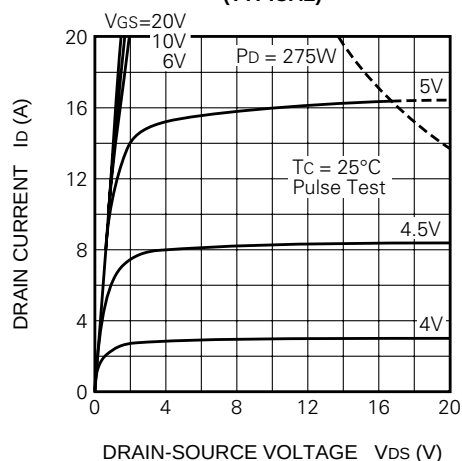
MAXIMUM SAFE OPERATING AREA



OUTPUT CHARACTERISTICS (TYPICAL)



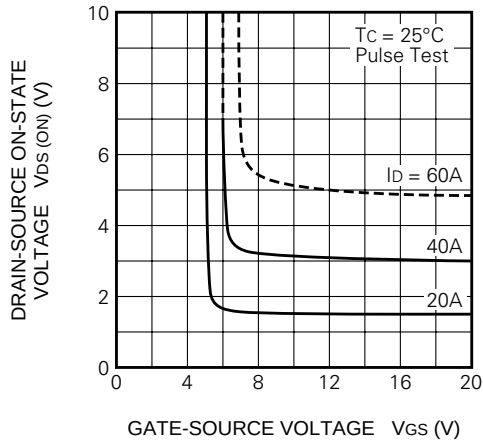
OUTPUT CHARACTERISTICS (TYPICAL)



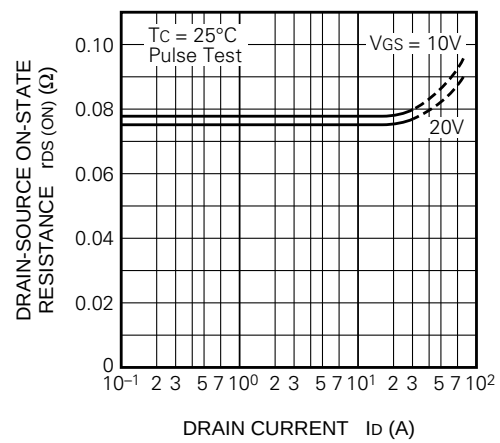
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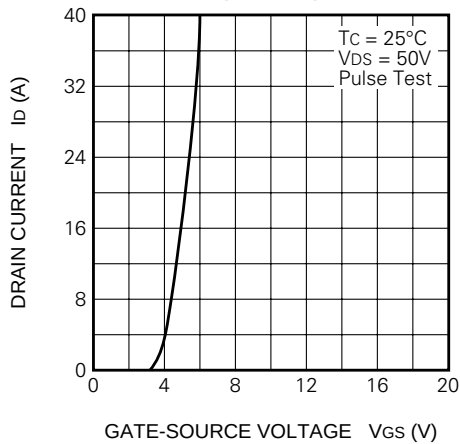
ON-STATE VOLTAGE VS.  
GATE-SOURCE VOLTAGE  
(TYPICAL)



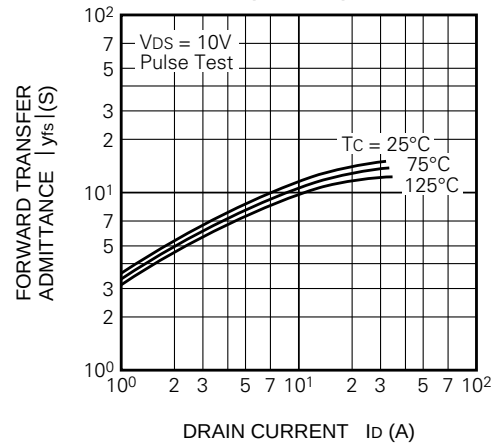
ON-STATE RESISTANCE VS.  
DRAIN CURRENT  
(TYPICAL)



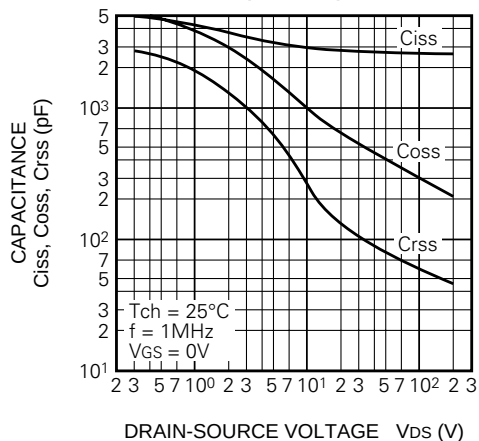
TRANSFER CHARACTERISTICS  
(TYPICAL)



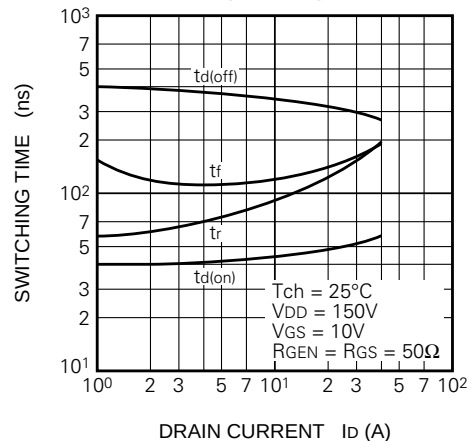
FORWARD TRANSFER ADMITTANCE  
VS. DRAIN CURRENT  
(TYPICAL)



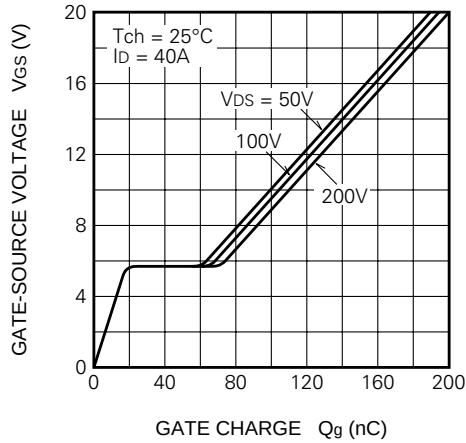
CAPACITANCE VS.  
DRAIN-SOURCE VOLTAGE  
(TYPICAL)



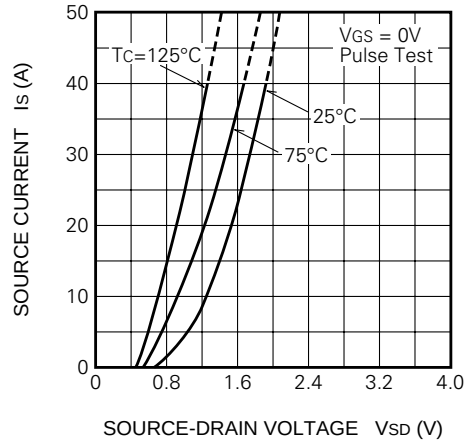
SWITCHING CHARACTERISTICS  
(TYPICAL)



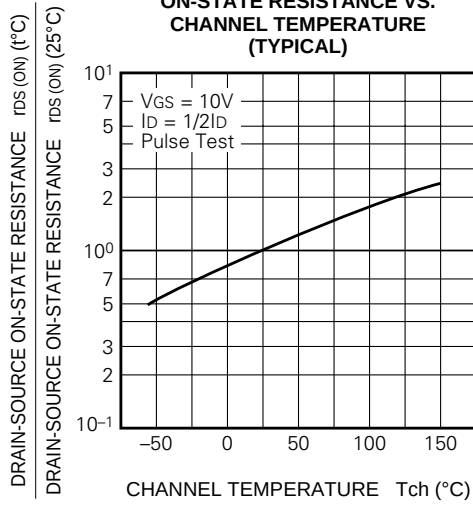
GATE-SOURCE VOLTAGE  
VS. GATE CHARGE  
(TYPICAL)



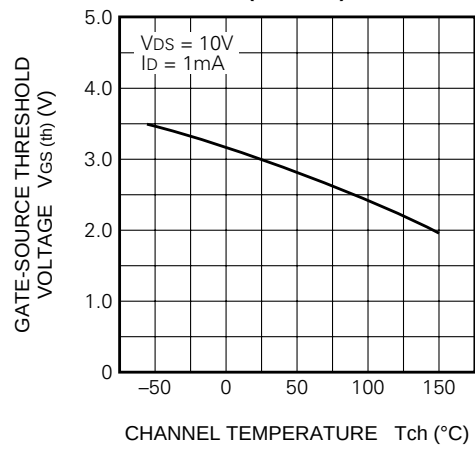
SOURCE-DRAIN DIODE  
FORWARD CHARACTERISTICS  
(TYPICAL)



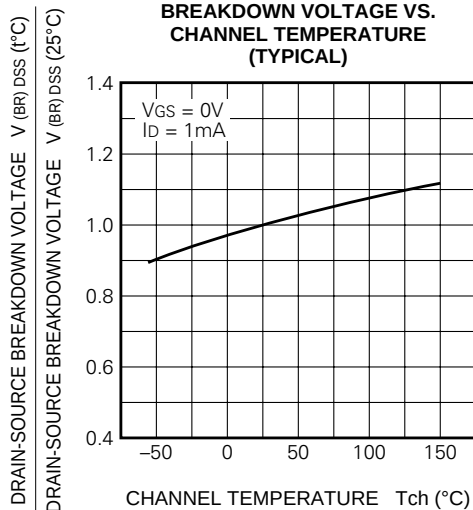
ON-STATE RESISTANCE VS.  
CHANNEL TEMPERATURE  
(TYPICAL)



THRESHOLD VOLTAGE VS.  
CHANNEL TEMPERATURE  
(TYPICAL)



BREAKDOWN VOLTAGE VS.  
CHANNEL TEMPERATURE  
(TYPICAL)



TRANSIENT THERMAL IMPEDANCE  
CHARACTERISTICS

