*Product Preview*

## Medium Power Surface Mount Products

# TMOS Single P-Channel Field Effect Transistors

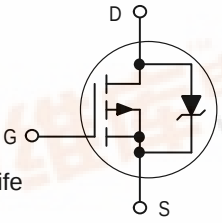
**MMSF3305**

**Motorola Preferred Device**

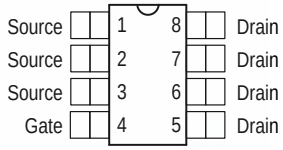
**SINGLE TMOS POWER MOSFET 9.1 AMPERES 30 VOLTS $R_{DS(on)}$ = 0.02 OHM**

WaveFET™ devices are an advanced series of power MOSFETs which utilize Motorola's High Cell Density HDTMOS process. These miniature surface mount MOSFETs feature ultra low $R_{DS(on)}$ and true logic level performance. They are capable of withstanding high energy in the avalanche and commutation modes and the drain–to–source diode has a very low reverse recovery time. WaveFET™ devices are designed for use in low voltage, high speed switching applications where power efficiency is important. Typical applications are dc–dc converters, and power management in portable and battery powered products such as computers, printers, cellular and cordless phones. They can also be used for low voltage motor controls in mass storage products such as disk drives and tape drives. The avalanche energy is specified to eliminate the guesswork in designs where inductive loads are switched and offer additional safety margin against unexpected voltage transients.

- Ultra Low $R_{DS(on)}$ Provides Higher Efficiency and Extends Battery Life
- Logic Level Gate Drive — Can Be Driven by Logic ICs
- Miniature SO–8 Surface Mount Package — Saves Board Space
- Diode Is Characterized for Use In Bridge Circuits
- Diode Exhibits High Speed, With Soft Recovery
- $I_{DSS}$ Specified at Elevated Temperature
- Avalanche Energy Specified
- Mounting Information for SO–8 Package Provided




**CASE 751–05, Style 13**
**SO–8**




**DEVICE MARKING**

**ORDERING INFORMATION**

| | Device | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|
| S3305 | MMSF3305R2 | 13″ | 12 mm embossed tape | 4000 units |

**Preferred** devices are Motorola recommended choices for future use and best overall value.

This document contains information on a product under development. Motorola reserves the right to change or discontinue this product without notice.

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise noted)

**Negative sign for P–Channel devices omitted for clarity**

| Rating | | Symbol | Max | Unit |
|---|---|---|---|---|
| Drain–to–Source Voltage | | $V_{DSS}$ | 30 | V |
| Drain–to–Gate Voltage ($R_{GS}$ = 1.0 MΩ) | | $V_{DGR}$ | 20 | V |
| Gate–to–Source Voltage — Continuous | | $V_{GS}$ | ± 20 | V |
| 1 inch SQ.<br>FR–4 or G–10 PCB | Thermal Resistance — Junction to Ambient<br>Total Power Dissipation @ $T_A$ = 25°C<br>Linear Derating Factor<br>Drain Current — Continuous @ $T_A$ = 25°C<br>Continuous @ $T_A$ = 70°C | $R_{THJA}$<br>$P_D$<br><br>$I_D$<br>$I_D$ | 50<br>2.5<br>20<br>9.1<br>7.3 | °C/W<br>Watts<br>mW/°C<br>A<br>A |
| 10 seconds | Pulsed Drain Current (1) | $I_{DM}$ | 50 | A |
| Minimum<br>FR–4 or G–10 PCB | Thermal Resistance — Junction to Ambient<br>Total Power Dissipation @ $T_A$ = 25°C<br>Linear Derating Factor<br>Drain Current — Continuous @ $T_A$ = 25°C<br>Continuous @ $T_A$ = 70°C | $R_{THJA}$<br>$P_D$<br><br>$I_D$<br>$I_D$ | 80<br>1.56<br>12.5<br>7.2<br>5.8 | °C/W<br>Watts<br>mW/°C<br>A<br>A |
| 10 seconds | Pulsed Drain Current (1) | $I_{DM}$ | 40 | A |
| Operating and Storage Temperature Range | | $T_J$, $T_{stg}$ | – 55 to 150 | °C |
| Single Pulse Drain–to–Source Avalanche Energy — Starting $T_J$ = 25°C<br>($V_{DD}$ = 30 Vdc, $V_{GS}$ = 10 Vdc, Peak $I_L$ = 9.1 Apk, L = TBD mH, $R_G$ = 25 Ω) | | $E_{AS}$ | TBD | mJ |

(1) Repetitive rating; pulse width limited by maximum junction temperature.

**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain–to–Source Breakdown Voltage ($V_{GS}$ = 0 Vdc, $I_D$ = 0.25 mAdc) | (1) (3) | $V_{(BR)DSS}$ | 30 | — | — | Vdc |
| Temperature Coefficient (Positive) | | | — | — | — | mV/°C |
| Zero Gate Voltage Drain Current | | $I_{DSS}$ | | | | μAdc |
| ($V_{DS}$ = 30 Vdc, $V_{GS}$ = 0 Vdc) | | | — | — | 1.0 | |
| ($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0 Vdc, $T_J$ = 70°C) | | | — | — | 5.0 | |
| Gate–Body Leakage Current ($V_{GS}$ = ± 20 Vdc, $V_{DS}$ = 0) | | $I_{GSS}$ | — | — | 100 | nAdc |
| **ON CHARACTERISTICS(1)** | | | | | | |
| Gate Threshold Voltage ($V_{DS}$ = $V_{GS}$, $I_D$ = 0.25 mAdc) | (1) (3) | $V_{GS(th)}$ | 0.7 | — | 1.4 | Vdc |
| Threshold Temperature Coefficient (Negative) | | | — | — | — | mV/°C |
| Static Drain–to–Source On–Resistance | (1) (3) | $R_{DS(on)}$ | | | | mΩ |
| ($V_{GS}$ = 10 Vdc, $I_D$ = 9.1 Adc) | | | — | — | 20 | |
| ($V_{GS}$ = 4.5 Vdc, $I_D$ = 7.3 Adc) | | | — | — | 30 | |
| On–State Drain Current | | $I_{D(on)}$ | | | | A |
| ($V_{DS}$ ≤ 5.0 V, $V_{GS}$ = 10 V) | | | 40 | — | — | |
| ($V_{DS}$ ≤ 5.0 V, $V_{GS}$ = 4.5 V) | | | 10 | — | — | |
| Forward Transconductance ($V_{DS}$ = 15 Vdc, $I_D$ = 8.0 Adc) | (1) | $g_{FS}$ | — | — | — | Mhos |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | ($V_{DS}$ = 30 Vdc, $V_{GS}$ = 0 Vdc, f = 1.0 MHz) | $C_{iss}$ | — | — | TBD | pF |
| Output Capacitance | | $C_{oss}$ | — | — | TBD | |
| Transfer Capacitance | | $C_{rss}$ | — | — | TBD | |
| **SWITCHING CHARACTERISTICS(2)** | | | | | | |
| Turn–On Delay Time | ($V_{DD}$ = 15 Vdc, $I_D$ = 1.0 Adc, $V_{GS}$ = 10 Vdc, $R_G$ = 6.0 Ω) (1) | $t_{d(on)}$ | — | — | TBD | ns |
| Rise Time | | $t_r$ | — | — | TBD | |
| Turn–Off Delay Time | | $t_{d(off)}$ | — | — | TBD | |
| Fall Time | | $t_f$ | — | — | TBD | |
| Gate Charge See Figure 8 | ($V_{DS}$ = 15 Vdc, $I_D$ = 4.6 Adc, $V_{GS}$ = 10 Vdc) (1) | $Q_T$ | — | — | TBD | nC |
| | | $Q_1$ | — | — | — | |
| | | $Q_2$ | — | — | — | |
| | | $Q_3$ | — | — | — | |
| **SOURCE–DRAIN DIODE CHARACTERISTICS** | | | | | | |
| Forward On–Voltage(1) | ($I_S$ = 2.1 Adc, $V_{GS}$ = 0 Vdc) (1) | $V_{SD}$ | — | — | 1.2 | Vdc |
| | ($I_S$ = 2.1 Adc, $V_{GS}$ = 0 Vdc, $T_J$ = 125°C) | | — | — | — | |
| Reverse Recovery Time See Figure 15 | ($I_S$ = 2.1 Adc, $V_{GS}$ = 0 Vdc, $dI_S/dt$ = 100 A/μs) (1) | $t_{rr}$ | — | — | TBD | ns |
| | | $t_a$ | — | — | — | |
| | | $t_b$ | — | — | — | |
| Reverse Recovery Stored Charge | | $Q_{RR}$ | — | — | — | μC |

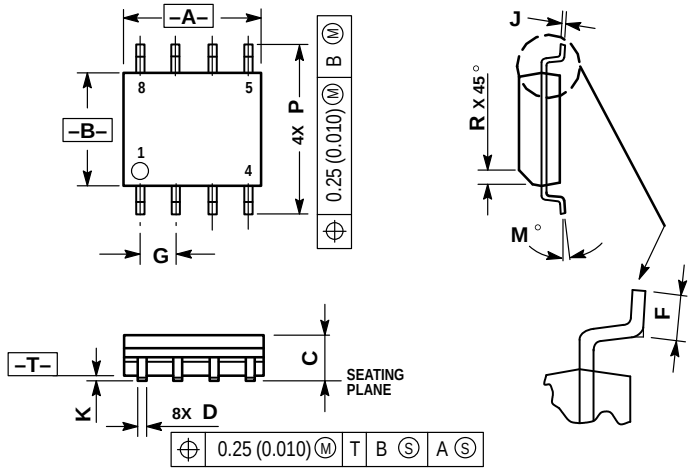
(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

(2) Switching characteristics are independent of operating junction temperature.

(3) Reflects typical values. $C_{pk} = \left| \frac{\text{Max limit – Typ}}{3 \times \text{SIGMA}} \right|$

(4) Repetitive rating; pulse width limited by maximum junction temperature.

## PACKAGE DIMENSIONS




NOTES:
1. DIMENSIONS A AND B ARE DATUMS AND T IS A DATUM SURFACE.
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
3. DIMENSIONS ARE IN MILLIMETER.
4. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
6. DIMENSION D DOES NOT INCLUDE MOLD PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | 4.80 | 5.00 |
| B | 3.80 | 4.00 |
| C | 1.35 | 1.75 |
| D | 0.35 | 0.49 |
| F | 0.40 | 1.25 |
| G | 1.27 BSC | |
| J | 0.18 | 0.25 |
| K | 0.10 | 0.25 |
| M | 0° | 7° |
| P | 5.80 | 6.20 |
| R | 0.25 | 0.50 |

STYLE 13:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. DRAIN
8. DRAIN

**CASE 751–05**
**SO–8**
**ISSUE P**



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