**MOTOROLA**
**SEMICONDUCTOR**
**TECHNICAL DATA**

*Advance Information*

# TMOS E-FET™
# Power Field Effect Transistor
## N-Channel Enhancement-Mode Silicon Gate

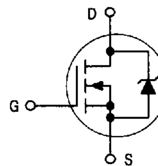
**MTW8N50E**

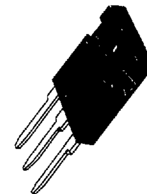
Motorola Preferred Device

**TMOS POWER FET**
**8.0 AMPERES**
**$R_{DS(on)}$ = 0.80 OHM**
**500 VOLTS**

This advanced TMOS E-FET is designed to withstand high energy in the avalanche and commutation modes. The new energy efficient design also offers a drain-to-source diode with a fast recovery time. Designed for high voltage, high speed switching applications in power supplies, converters and PWM motor controls, these devices are particularly well suited for bridge circuits where diode speed and commutating safe operating areas are critical and offer additional safety margin against unexpected voltage transients.

- Avalanche Energy Specified
- Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- Diode is Characterized for Use in Bridge Circuits
- $I_{DSS}$ and $V_{DS(on)}$ Specified at Elevated Temperature



CASE 340F-03
TO-247AE

3

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

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DSS}$ | 500 | Vdc |
| Drain-Gate Voltage ($R_{GS}$ = 1.0 MΩ) | $V_{DGR}$ | 500 | Vdc |
| Gate-Source Voltage — Continuous | $V_{GS}$ | ±20 | Vdc |
| Drain Current — Continuous @ $T_C$ = 25°C<br>— Continuous @ $T_C$ = 100°C<br>— Single Pulse ($t_p \leq$ 10 μs) | $I_D$<br>$I_D$<br>$I_{DM}$ | 8.0<br>5 0<br>32 | Adc<br><br>Apk |
| Total Power Dissipation @ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 150<br>1.0 | Watts<br>W/°C |
| 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>($V_{DD}$ = 50 Vdc, $V_{GS}$ = 10 Vpk, $I_L$ = 8 0 Apk, L = 10 4 mH, $R_G$ = 25 Ω) | $E_{AS}$ | 430 | mJ |
| Thermal Resistance — Junction to Case<br>— Junction to Ambient | $R_{\theta JC}$<br>$R_{\theta JA}$ | 1 0<br>40 | °C/W |
| Maximum Lead Temperature for Soldering Purposes, 1/8″ from case for 5 seconds | $T_L$ | 260 | °C |

This document contains information on a new product Specifications and information are subject to change without notice

E FET is a trademark of Motorola Inc
TMOS is a registered trademark of Motorola Inc

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

3

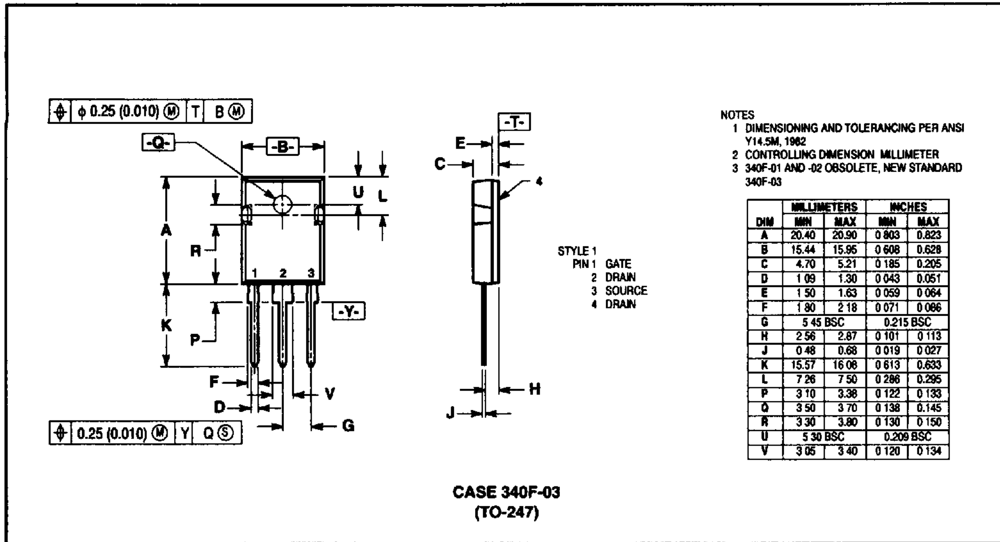
**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Drain-Source Breakdown Voltage ($V_{GS}$ = 0 V, $I_D$ = 250 µAdc) | $BV_{DSS}$ | 500 | — | — | Vdc |
| Temperature Coefficient (Positive) | | — | 500 | — | mV/°C |
| Zero Gate Voltage Drain Current ($V_{DS}$ = 500 Vdc, $V_{GS}$ = 0) | $I_{DSS}$ | — | — | 250 | µAdc |
| ($V_{DS}$ = 500 Vdc, $V_{GS}$ = 0, $T_J$ = 125°C) | | — | — | 1000 | |
| Gate-Body Leakage Current ($V_{GS}$ = ±20 Vdc, $V_{DS}$ = 0) | $I_{GSS}$ | — | — | 100 | nAdc |
| **ON CHARACTERISTICS*** | | | | | |
| Gate Threshold Voltage ($V_{DS}$ = $V_{GS}$, $I_D$ = 250 µAdc) | $V_{GS(th)}$ | 2.0 | — | 4 0 | Vdc |
| Temperature Coefficient (Negative) | | — | 5 0 | — | mV/°C |
| Static Drain-Source On-Resistance ($V_{GS}$ = 10 Vdc, $I_D$ = 4.0 Adc) | $R_{DS(on)}$ | — | | 0.8 | Ohm |
| Drain-Source On-Voltage ($V_{GS}$ = 10 Vdc) ($I_D$ = 8.0 Adc) | $V_{DS(on)}$ | — | — | 7 6 | Vpk |
| ($I_D$ = 4.0 Adc, $T_J$ = 125°C) | | — | — | 6.4 | |
| Forward Transconductance ($V_{DS}$ = 50 Vdc, $I_D$ = 4.0 Adc) | $g_{FS}$ | 4.0 | — | — | mhos |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Input Capacitance ($V_{DS}$ = 25, Vdc, $V_{GS}$ = 0, f = 1 0 MHz) | $C_{iss}$ | — | 1200 | 1800 | pF |
| Output Capacitance | $C_{oss}$ | — | 176 | 264 | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 72 | 108 | |
| **SWITCHING CHARACTERISTICS*†** | | | | | |
| Turn-On Delay Time ($V_{DD}$ = 250 Vdc, $I_D$ = 8 0 Adc, $V_{GS}$ = 10 Vdc, $R_g$ = 9 1 Ω) | $t_{d(on)}$ | — | 25 | 50 | ns |
| Rise Time | $t_r$ | — | 36 | 72 | |
| Turn-Off Delay Time | $t_{d(off)}$ | — | 75 | 150 | |
| Fall Time | $t_f$ | — | 30 | 60 | |
| Gate Charge ($V_{DS}$ = 400 Vdc, $I_D$ = 8.0 Adc, $V_{GS}$ = 10 Vdc) | $Q_T$ | — | 92 | 125 | nC |
| | $Q_1$ | — | 12 | — | |
| | $Q_2$ | — | 45 | — | |
| | $Q_3$ | — | 35 | — | |
| **SOURCE-DRAIN DIODE CHARACTERISTICS*** | | | | | |
| Forward On-Voltage ($I_S$ = 8 0 Adc, $V_{GS}$ = 0) | $V_{SD}$ | — | 1.1 | 2 0 | Vdc |
| ($I_S$ = 8.0 Adc, $V_{GS}$ = 0, $T_J$ = 125°C) | | — | 1.0 | — | |
| Reverse Recovery Time ($I_S$ = 8.0 Adc, $V_{GS}$ = 0, $dI_S/dt$ = 100 A/µs) | $t_{rr}$ | — | 420 | — | ns |
| | $t_a$ | — | 280 | — | |
| | $t_b$ | — | 140 | — | |
| Reverse Recovery Stored Charge | $Q_{RR}$ | — | 4 4 | — | µC |
| **INTERNAL PACKAGE INDUCTANCE** | | | | | |
| Internal Drain Inductance (Measured from the contact screw on tab to center of die) | $L_D$ | — | — | — | nH |
| (Measured from the drain lead 0 25″ from package to center of die) | | — | 5.0 | — | |
| Internal Source Inductance (Measured from the source lead 0.25″ from package to source bond pad) | $L_S$ | — | 13 | — | nH |

*Pulse Test Pulse Width ≤ 300 µs, Duty Cycle ≤ 2%

† Switching characteristics are independent of operating junction temperature

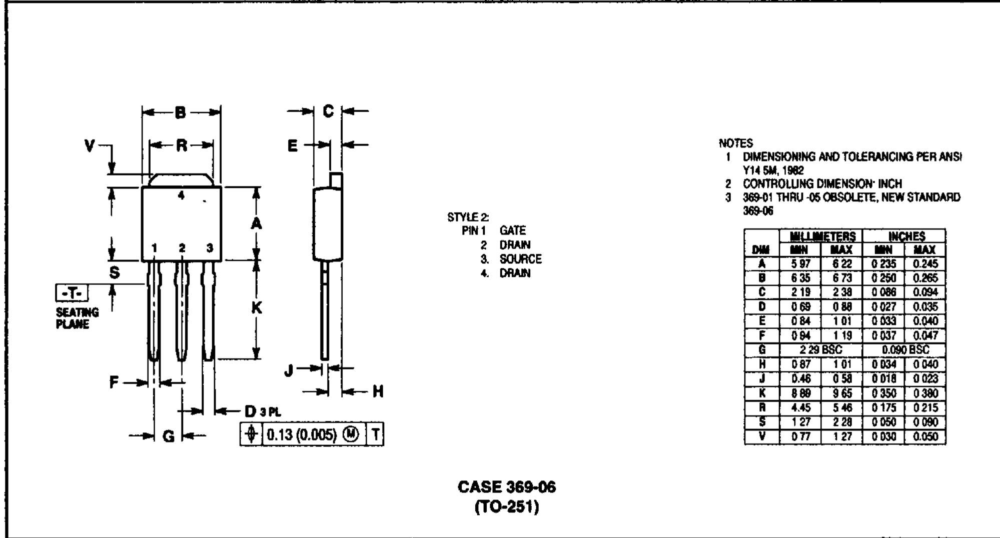
## PACKAGE OUTLINE DIMENSIONS AND FOOTPRINTS (continued)




NOTES
1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982
2 CONTROLLING DIMENSION MILLIMETER
3 340F-01 AND -02 OBSOLETE, NEW STANDARD 340F-03

| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 20.40 | 20.90 | 0.803 | 0.823 |
| B | 15.44 | 15.95 | 0.608 | 0.628 |
| C | 4.70 | 5.21 | 0.185 | 0.205 |
| D | 1.09 | 1.30 | 0.043 | 0.051 |
| E | 1.50 | 1.63 | 0.059 | 0.064 |
| F | 1.80 | 2.18 | 0.071 | 0.086 |
| G | 5.45 BSC | | 0.215 BSC | |
| H | 2.56 | 2.87 | 0.101 | 0.113 |
| J | 0.48 | 0.68 | 0.019 | 0.027 |
| K | 15.57 | 16.08 | 0.613 | 0.633 |
| L | 7.26 | 7.50 | 0.286 | 0.295 |
| P | 3.10 | 3.38 | 0.122 | 0.133 |
| Q | 3.50 | 3.70 | 0.138 | 0.145 |
| R | 3.30 | 3.80 | 0.130 | 0.150 |
| U | 5.30 BSC | | 0.209 BSC | |
| V | 3.05 | 3.40 | 0.120 | 0.134 |

**CASE 340F-03 (TO-247)**




NOTES
1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982
2 CONTROLLING DIMENSION: INCH
3 369-01 THRU -05 OBSOLETE, NEW STANDARD 369-06

| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 5.97 | 6.22 | 0.235 | 0.245 |
| B | 6.35 | 6.73 | 0.250 | 0.265 |
| C | 2.19 | 2.38 | 0.086 | 0.094 |
| D | 0.69 | 0.88 | 0.027 | 0.035 |
| E | 0.84 | 1.01 | 0.033 | 0.040 |
| F | 0.94 | 1.19 | 0.037 | 0.047 |
| G | 2.29 BSC | | 0.090 BSC | |
| H | 0.87 | 1.01 | 0.034 | 0.040 |
| J | 0.46 | 0.58 | 0.018 | 0.023 |
| K | 8.89 | 9.65 | 0.350 | 0.380 |
| R | 4.45 | 5.46 | 0.175 | 0.215 |
| S | 1.27 | 2.28 | 0.050 | 0.090 |
| V | 0.77 | 1.27 | 0.030 | 0.050 |

**CASE 369-06 (TO-251)**

5