# N-Channel Enhancement-Mode MOSFET Transistor

## **Product Summary**

| V <sub>(BR)DSS</sub> Min (V) | $\mathbf{r}_{\mathbf{DS(on)}} \operatorname{Max}(\Omega)$ | $V_{GS(th)}(V)$ | I <sub>D</sub> (A) |  |
|------------------------------|---|-----------------|--------------------|--|
| 200                          | 11  | 0.8 to 3.0      | 0.12               |  |

### Features

- Low On-Resistance: 9.5  $\Omega$
- Secondary Breakdown Free: 220 V
- Low Power/Voltage Driven
- Low Input and Output Leakage
- Excellent Thermal Stability

## Benefits

- Low Offset Voltage
- Full-Voltage Operation
- Easily Driven Without Buffer
- Low Error Voltage
- No High-Temperature "Run-Away"

### Applications

- High-Voltage Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Transistors, etc.
- Telephone Mute Switches, Ringer Circuits
- Power Supply, Converters
- Motor Control



TN2010T (R1)\*

\*Marking Code for TO-236

## Absolute Maximum Ratings ( $T_A = 25^{\circ}C$ Unless Otherwise Noted)

| Parameter  |                      | Symbol                            | Limit      | Unit |  |
|--|----------------------|-----------------------------------|------------|------|--|
| Drain-Source Voltage                             |                      | V <sub>DS</sub>                   | 200        | v    |  |
| Gate-Source Voltage                              |                      | V <sub>GS</sub>                   | $\pm 20$   |      |  |
| Continuous Drain Current $(T_J = 150^{\circ}C)$  | $T_A = 25 \degree C$ | I_                                | 0.12       |      |  |
|  | $T_A = 70^{\circ}C$  | ID                                | 0.08       | А    |  |
| Pulsed Drain Current <sup>a</sup>                |                      | I <sub>DM</sub>                   | 0.34       |      |  |
| Power Dissipation                                | $T_A = 25 \degree C$ | D_                                | 0.35       | w    |  |
|  | $T_A = 70^{\circ}C$  | гD                                | 0.22       |      |  |
| Maximum Junction-to-Ambient                      |                      | R <sub>thJA</sub>                 | 357        | °C/W |  |
| Operating Junction and Storage Temperature Range |                      | T <sub>J</sub> , T <sub>stg</sub> | -55 to 150 | °C   |  |

Notes

a. Pulse width limited by maximum junction temperature.

Updates to this data sheet may be obtained via facsimile by calling Siliconix FaxBack, 1-408-970-5600. Please request FaxBack document #70203.

# **Specifications**<sup>a</sup>

|   |                      |  |     | Limits |         |      |  |  |  |
|---|----------------------|--|-----|--------|---------|------|--|--|--|
| Parameter                               | Symbol               | Test Conditions  | Min | Typb   | Max     | Unit |  |  |  |
| Static                                  |                      |  |     |        |         |      |  |  |  |
| Drain-SourceBreakdown Voltage           | V <sub>(BR)DSS</sub> | $V_{GS}$ = 0 V, $I_D$ = 100 $\mu A$  |     | 220    |         | N    |  |  |  |
| Gate-Threshold Voltage                  | V <sub>GS(th)</sub>  | $V_{DS}=V_{GS},I_D=0.25~mA$  | 0.8 | 1.6    | 3.0     | v    |  |  |  |
| Gate-Body Leakage                       | I <sub>GSS</sub>     | $V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$  |     |        | ±100    | nA   |  |  |  |
| Zero Gate Voltage Drain Current         | I <sub>DSS</sub>     | $V_{DS}$ = 160 V, $V_{GS}$ = 0 V $T_{J}$ = -55 $^{\circ}\mathrm{C}$                                  |     |        | 1<br>10 | μΑ   |  |  |  |
| On-State Drain Current <sup>c</sup>     | I <sub>D(on)</sub>   | $V_{DS}=10~$ V, $V_{GS}=10~$ V   | 0.3 |        |         | mA   |  |  |  |
| Drain-Source On-Resistance <sup>c</sup> | r <sub>DS(on)</sub>  | $V_{GS} = 10$ V, $I_D = 0.1$ A   |     | 9.5    | 11      |      |  |  |  |
|   |                      | $V_{GS} = 4.5 \text{ V}, I_D = 0.05 \text{ mA}$  |     | 10     | 15      | 2    |  |  |  |
| Forward Transconductance <sup>c</sup>   | gfs                  | $V_{DS} = 10$ V, $I_D = 0.1$ A   |     | 300    |         | mS   |  |  |  |
| Diode Forward Voltage                   | V <sub>SD</sub>      | $I_S = 0.085 \text{ A}, V_{GS} = 0 \text{ V}$  |     | 0.8    |         | V    |  |  |  |
| Dynamic                                 |                      |  |     |        |         |      |  |  |  |
| Total Gate Charge                       | Qg                   | $V_{DS}$ = 100 V, $V_{GS}$ = 10 V, $I_D \simeq 0.1$ A  |     | 1750   |         | pC   |  |  |  |
| Gate-Source Charge                      | Qgs                  |  |     | 275    |         |      |  |  |  |
| Gate-Drain Charge                       | Qgd                  |  |     | 300    |         |      |  |  |  |
| Input Capacitance                       | Ciss                 | $V_{\rm DS}$ = 25 V, $V_{\rm GS}$ = 0 V, f = 1 MHz   |     | 35     |         | pF   |  |  |  |
| Output Capacitance                      | C <sub>oss</sub>     |  |     | 6      |         |      |  |  |  |
| Reverse Transfer Capacitance            | C <sub>rss</sub>     |  |     | 2      |         |      |  |  |  |
| Switching <sup>d</sup>                  |                      |  |     |        |         |      |  |  |  |
| Turn-On Time                            | t <sub>d(on)</sub>   |  |     | 4      |         | ns   |  |  |  |
|   | t <sub>r</sub>       | $V_{DD} = 60 \text{ V}, R_L = 600 \Omega$<br>$I_D \approx 0.1 \text{ A} \text{ Vorm} = 10 \text{ V}$ |     | 16     |         |      |  |  |  |
| Turn-Off Time                           | t <sub>d(off)</sub>  | $R_G = 6 \Omega$   |     | 16     |         |      |  |  |  |
|   | t <sub>f</sub>       |  |     | 45     |         |      |  |  |  |

Notes
a. T<sub>A</sub> = 25°C unless otherwise noted.
b. For DESIGN AID ONLY, not subject to production testing.
c. Pulse test: PW ≤ 300 μs duty cycle ≤ 2%.
d. Switching time is essentially independent of operating temperature.



#### **Typical Characteristics (25°C Unless Otherwise Noted)**

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# Typical Characteristics (25°C Unless Otherwise Noted)





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