

# MT9410

## N-Channel PowerTrench<sup>®</sup> MOSFET 30V, 5.6A, 25mΩ

### General Description

This N-Channel MOSFET is produced using Mos-tech Semiconductor's advanced PowerTrench process that has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

These devices are well suited for low voltage and battery powered applications where low in line power loss and fast switching are required.

### Features

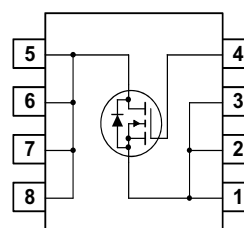
- $R_{DS(on)} = 25m\Omega$ ,  $V_{GS} = 10V$ ,  $I_D = 5.6A$
- $R_{DS(on)} = 36m\Omega$ ,  $V_{GS} = 4.5V$ ,  $I_D = 5.6A$
- Low gate charge(9.5nC typical)
- High performance trench technology for extremely low  $R_{DS(ON)}$
- High power and current handling capability



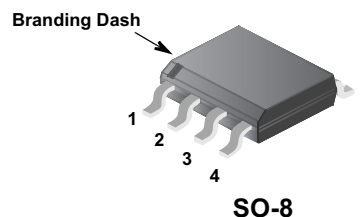
**MT Semiconductor<sup>®</sup>**

<http://www.mtsemi.com>

### Simplified Schematic



### MARKING DIAGRAM & PIN ASSIGNMENT



### Absolute Maximum Ratings ( $T_A = 25^\circ C$ unless otherwise noted)

| Symbol         | Parameter  | Ratings         | Units      |
|----------------|--|-----------------|------------|
| $V_{DSS}$      | Drain-Source Voltage                             | 30              | V          |
| $V_{GSS}$      | Gate-Source Voltage                              | $\pm 20$        | V          |
| $I_D$          | Drain Current – Continuous (Note 1a)             | 5.6             | A          |
|                | – Pulsed   | 28              |            |
| $P_D$          | Power Dissipation for Single Operation (Note 1a) | 2.5             | W          |
|                | (Note 1b)  | 1.2             |            |
|                | (Note 1c)  | 1.0             |            |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | $-55$ to $+175$ | $^\circ C$ |

### Thermal Characteristics

|                 |   |    |              |
|-----------------|---|----|--------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 50 | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 1)     | 25 |              |

### Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape width | Quantity   |
|----------------|--------|-----------|------------|------------|
| MT9410         | MT9410 | 13"       | 12mm       | 2500 units |

### Electrical Characteristics

T<sub>A</sub> = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

#### Off Characteristics

|                                      |   |  |    |    |      |       |
|--------------------------------------|---|--|----|----|------|-------|
| BV <sub>DSS</sub>                    | Drain–Source Breakdown Voltage            | V <sub>GS</sub> = 0 V, I <sub>b</sub> = 250 μA | 30 |    |      | V     |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | I <sub>b</sub> = 250 μA, Referenced to 25°C    |    | 21 |      | mV/°C |
| I <sub>bSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = 24 V, V <sub>GS</sub> = 0 V  |    |    | 1    | μA    |
| I <sub>GSSF</sub>                    | Gate–Body Leakage, Forward                | V <sub>GS</sub> = 25 V, V <sub>DS</sub> = 0 V  |    |    | 100  | nA    |
| I <sub>GSSR</sub>                    | Gate–Body Leakage, Reverse                | V <sub>GS</sub> = –25 V, V <sub>DS</sub> = 0 V |    |    | –100 | nA    |

#### On Characteristics (Note 2)

|  |  |   |    |                |                |       |
|--|--|---|----|----------------|----------------|-------|
| V <sub>GS(th)</sub>                    | Gate Threshold Voltage                         | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>b</sub> = 250 μA   | 1  | 1.8            | 2              | V     |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | I <sub>b</sub> = 250 μA, Referenced to 25°C   |    | –6             |                | mV/°C |
| R <sub>DS(on)</sub>                    | Static Drain–Source On–Resistance              | V <sub>GS</sub> = 10 V, I <sub>b</sub> = 5.6 A<br>V <sub>GS</sub> = 4.5 V, I <sub>b</sub> = 5.6 A<br>V <sub>GS</sub> = 10 V, I <sub>b</sub> = 5.6 A, T <sub>J</sub> = 125°C |    | 25<br>36<br>28 | 38<br>50<br>45 | mΩ    |
| I <sub>D(on)</sub>                     | On–State Drain Current                         | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 5 V   | 20 |                |                | A     |
| g <sub>FS</sub>                        | Forward Transconductance                       | V <sub>DS</sub> = 10 V, I <sub>b</sub> = 5.6 A  |    | 24             |                | S     |

#### Dynamic Characteristics

|                  |                              |   |  |     |  |    |
|------------------|------------------------------|---|--|-----|--|----|
| C <sub>iss</sub> | Input Capacitance            | V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V,<br>f = 1.0 MHz |  | 927 |  | pF |
| C <sub>oss</sub> | Output Capacitance           |   |  | 241 |  | pF |
| C <sub>rss</sub> | Reverse Transfer Capacitance |   |  | 97  |  | pF |

#### Switching Characteristics (Note 2)

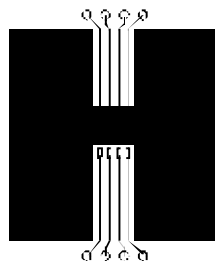
|                     |                     |   |  |     |    |    |
|---------------------|---------------------|---|--|-----|----|----|
| t <sub>d(on)</sub>  | Turn–On Delay Time  | V <sub>DD</sub> = 15 V, I <sub>b</sub> = 1 A,<br>V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 6 Ω |  | 7.4 | 15 | ns |
| t <sub>r</sub>      | Turn–On Rise Time   |   |  | 7.5 | 15 | ns |
| t <sub>d(off)</sub> | Turn–Off Delay Time |   |  | 25  | 40 | ns |
| t <sub>f</sub>      | Turn–Off Fall Time  |   |  | 5   | 10 | ns |
| Q <sub>g</sub>      | Total Gate Charge   | V <sub>DS</sub> = 15 V, I <sub>b</sub> = 5.6 A,<br>V <sub>GS</sub> = 5 V                        |  | 9.5 | 13 | nC |
| Q <sub>gs</sub>     | Gate–Source Charge  |   |  | 3.3 |    | nC |
| Q <sub>gd</sub>     | Gate–Drain Charge   |   |  | 3.1 |    | nC |

#### Drain–Source Diode Characteristics and Maximum Ratings

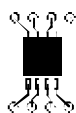
|                 |   |   |  |     |     |    |
|-----------------|---|---|--|-----|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain–Source Diode Forward Current |   |  | 2.1 | A   |    |
| V <sub>SD</sub> | Drain–Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2.1 A (Note 2)    |  | 0.7 | 1.2 | V  |
| t <sub>rr</sub> | Diode Reverse Recovery Time                           | I <sub>F</sub> = 5.6 A,<br>dI <sub>F</sub> /dt = 100 A/μs |  | 22  |     | nS |
| Q <sub>rr</sub> | Diode Reverse Recovery Charge                         |   |  | 20  |     | nC |

**Notes :**

- R<sub>θJA</sub> is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R<sub>θJC</sub> is guaranteed by design while R<sub>θCA</sub> is determined by the user's board design.



a) 50°C/W when mounted on a 1in<sup>2</sup> pad of 2 oz copper



b) 105°C/W when mounted on a .04 in<sup>2</sup> pad of 2 oz copper



c) 125°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

- Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%

### Typical Characteristics

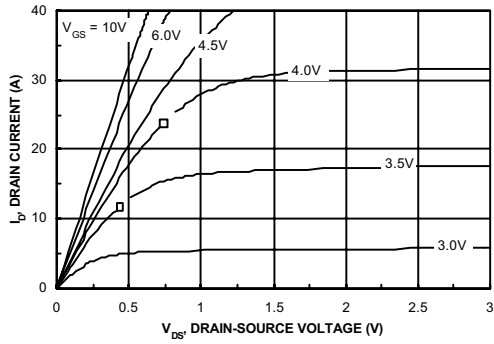


Figure 1. On-Region Characteristics.

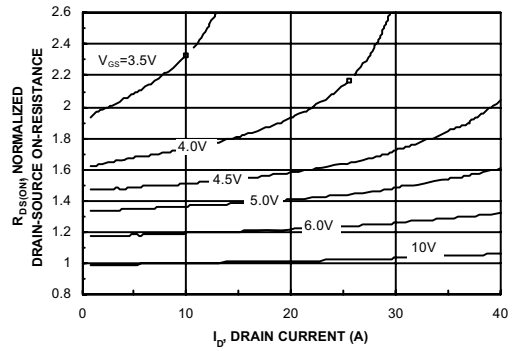


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

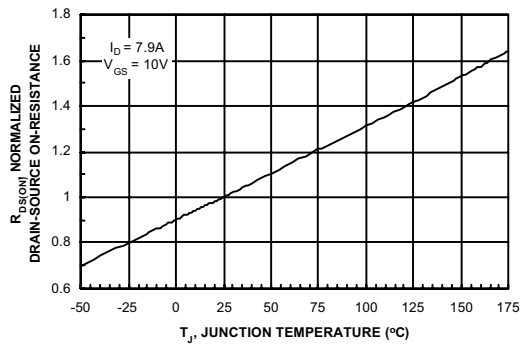


Figure 3. On-Resistance Variation with Temperature.

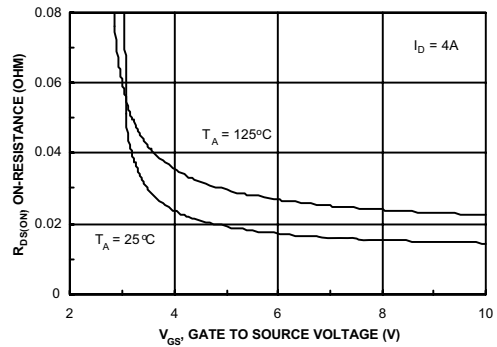


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

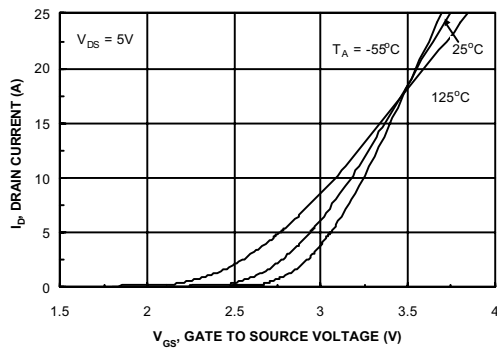


Figure 5. Transfer Characteristics.

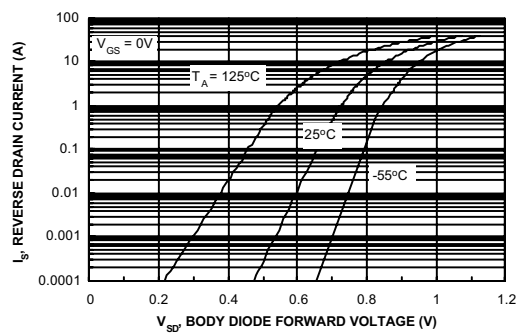


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

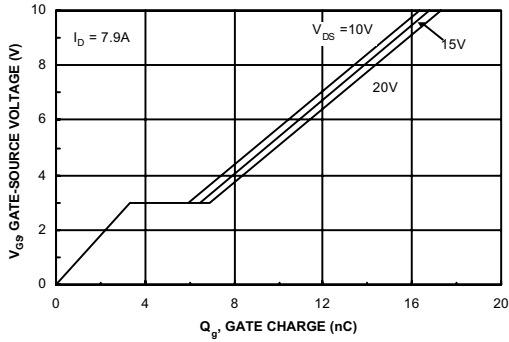


Figure 7. Gate Charge Characteristics.

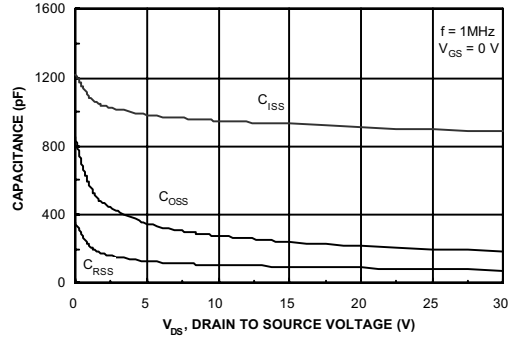


Figure 8. Capacitance Characteristics.

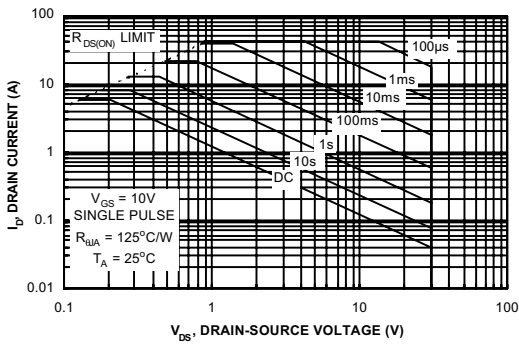


Figure 9. Maximum Safe Operating Area.

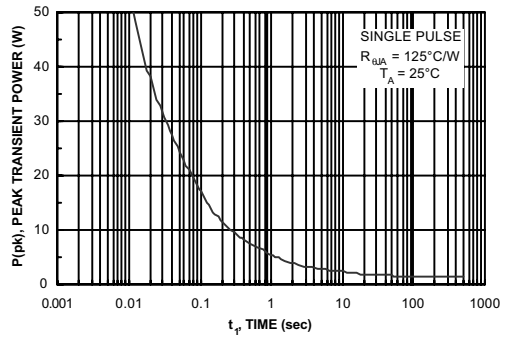


Figure 10. Single Pulse Maximum Power Dissipation.

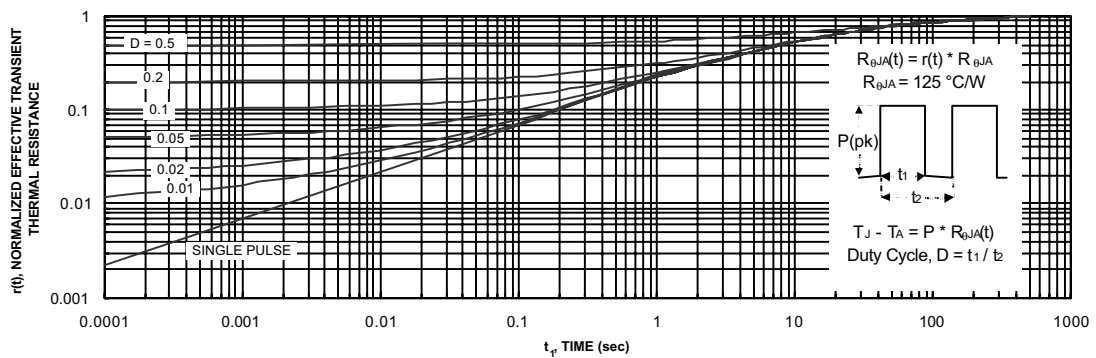
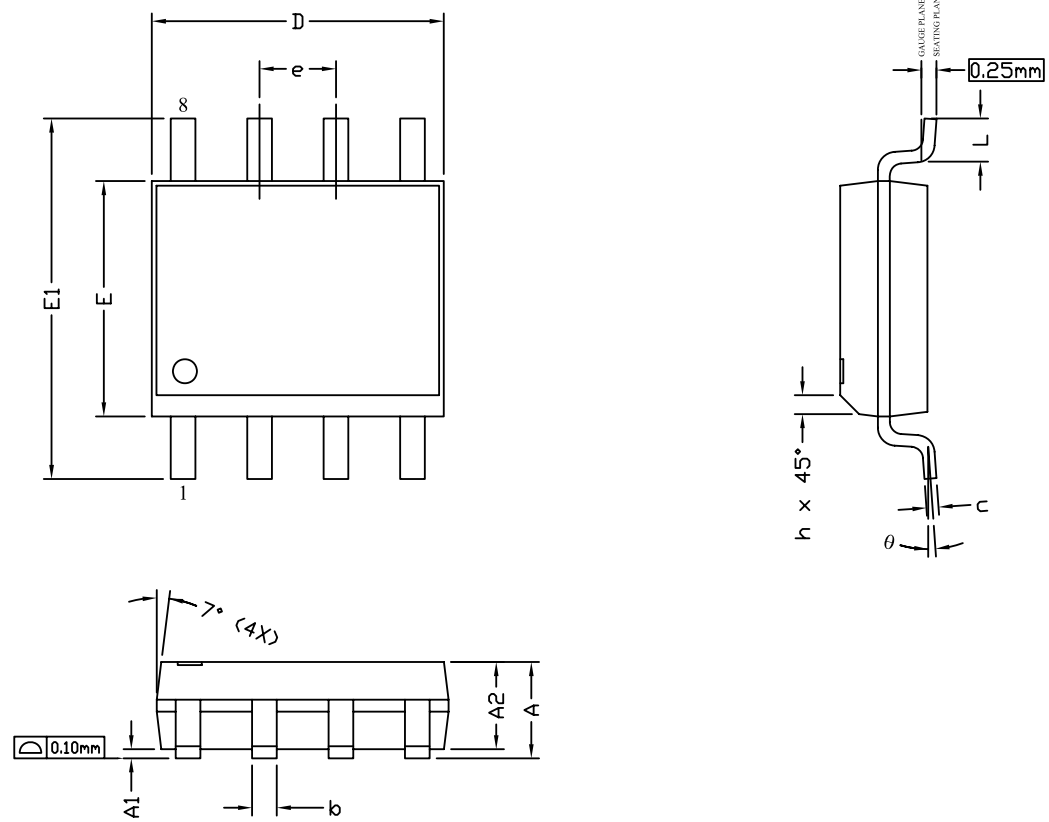


Figure 11. Transient Thermal Response Curve.

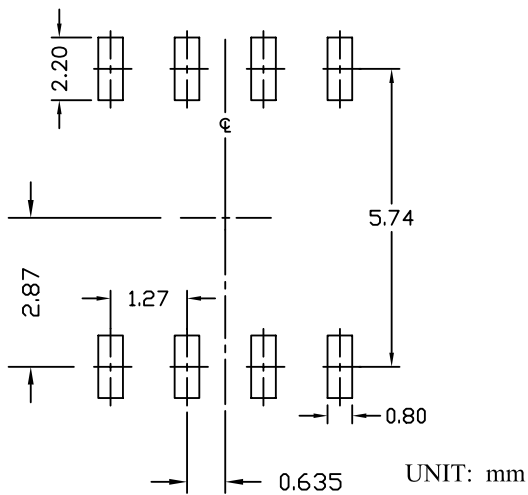
Thermal characterization performed using the conditions described in Note 1c. Transient thermal response will change depending on the circuit board design.

|              |          |
|--------------|----------|
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| Version      | rev H    |

S08 PACKAGE OUTLINE



RECOMMENDED LAND PATTERN



| SYMBOLS | DIMENSIONS IN MILLIMETERS |      |      | DIMENSIONS IN INCHES |       |       |
|---------|---------------------------|------|------|----------------------|-------|-------|
|         | MIN                       | NOM  | MAX  | MIN                  | NOM   | MAX   |
| A       | 1.35                      | 1.65 | 1.75 | 0.053                | 0.065 | 0.069 |
| A1      | 0.10                      | ---  | 0.25 | 0.004                | ---   | 0.010 |
| A2      | 1.25                      | 1.50 | 1.65 | 0.049                | 0.059 | 0.065 |
| b       | 0.31                      | ---  | 0.51 | 0.012                | ---   | 0.020 |
| c       | 0.17                      | ---  | 0.25 | 0.007                | ---   | 0.010 |
| D       | 4.80                      | 4.90 | 5.00 | 0.189                | 0.193 | 0.197 |
| E       | 3.80                      | 3.90 | 4.00 | 0.150                | 0.154 | 0.157 |
| e       | 1.27 BSC                  |      |      | 0.050 BSC            |       |       |
| E1      | 5.80                      | 6.00 | 6.20 | 0.228                | 0.236 | 0.244 |
| h       | 0.25                      | ---  | 0.50 | 0.010                | ---   | 0.020 |
| L       | 0.40                      | ---  | 1.27 | 0.016                | ---   | 0.050 |
| θ       | 0°                        | ---  | 8°   | 0°                   | ---   | 8°    |

NOTE

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONS ARE INCLUSIVE OF PLATING.
3. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.  
MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MILS EACH.
4. DIMENSION L IS MEASURED IN GAUGE PLANE.
5. CONTROLLING DIMENSION IS MILLIMETER.  
CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

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