

## F5851-VB Datasheet

### N- and P-Channel 20V (D-S) MOSFET

#### PRODUCT SUMMARY

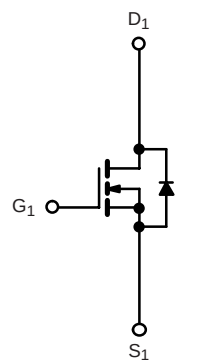
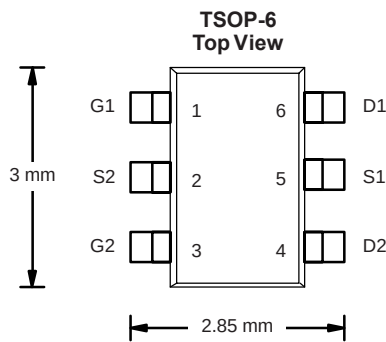
|           | $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )   | $I_D$ (A) |
|-----------|--------------|-----------------------------|-----------|
| N-Channel | 20           | 0.022 at $V_{GS} = 10$ V    | 5.5       |
|           |              | 0.030 at $V_{GS} = 4.5$ V   | 4.2       |
| P-Channel | - 20         | 0.055 at $V_{GS} = - 10$ V  | - 3.4     |
|           |              | 0.079 at $V_{GS} = - 4.5$ V | - 2.5     |

#### FEATURES

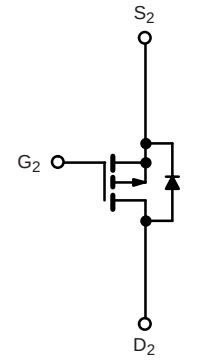
- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 %  $R_g$  Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available



N-Channel MOSFET



P-Channel MOSFET

#### ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted

| Parameter                                                          |                        | Symbol                            | N-Channel   | P-Channel | Unit |
|--------------------------------------------------------------------|------------------------|-----------------------------------|-------------|-----------|------|
| Drain-Source Voltage                                               |                        | V <sub>DS</sub>                   | 20          | - 20      | V    |
| Gate-Source Voltage                                                |                        | V <sub>GS</sub>                   | ± 20        | ± 20      |      |
| Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a, b</sup> | T <sub>A</sub> = 25 °C | I <sub>D</sub>                    | 5.5         | - 3.4     | A    |
|                                                                    | T <sub>A</sub> = 70 °C |                                   | 4.0         | - 2.3     |      |
| Pulsed Drain Current                                               |                        | I <sub>DM</sub>                   | 15          | 10        |      |
| Continuous Source Current (Diode Conduction) <sup>a, b</sup>       |                        | I <sub>S</sub>                    | 1.05        | - 1.05    |      |
| Maximum Power Dissipation <sup>a, b</sup>                          | T <sub>A</sub> = 25 °C | P <sub>D</sub>                    | 1.15        |           | W    |
|                                                                    | T <sub>A</sub> = 70 °C |                                   | 0.73        |           |      |
| Operating Junction and Storage Temperature Range                   |                        | T <sub>J</sub> , T <sub>stg</sub> | - 55 to 150 |           | °C   |

#### THERMAL RESISTANCE RATINGS

| Parameter                                | Symbol     | Typical | Maximum | Unit |
|------------------------------------------|------------|---------|---------|------|
| Maximum Junction-to-Ambient <sup>a</sup> | $R_{thJA}$ | 93      | 110     | °C/W |
|                                          |            | 130     | 150     |      |
| Maximum Junction-to-Lead                 | $R_{thJL}$ | 75      | 90      |      |

Notes:

a. Surface Mounted on FR4 board.

b.  $t \leq 5$  s.

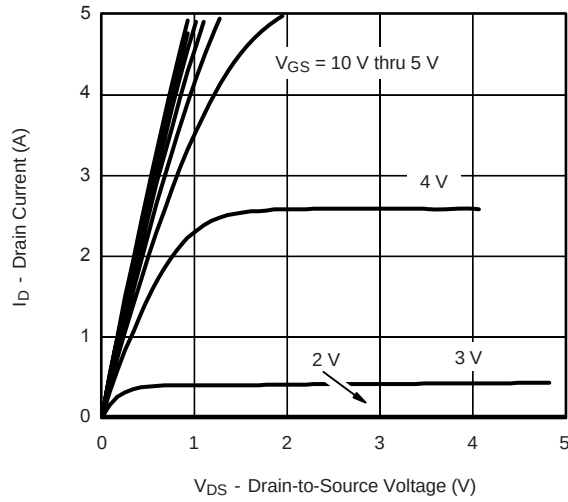
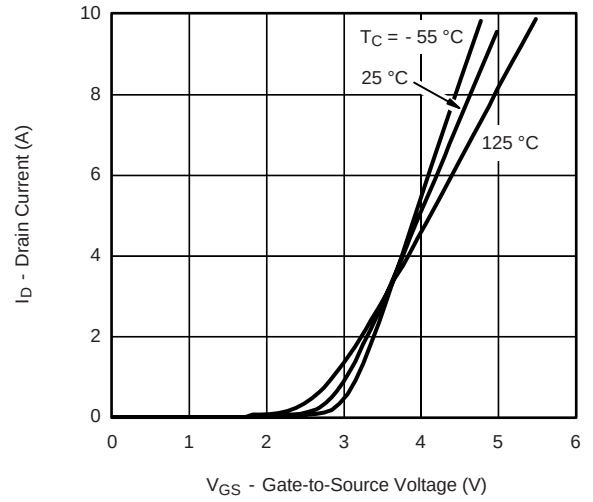
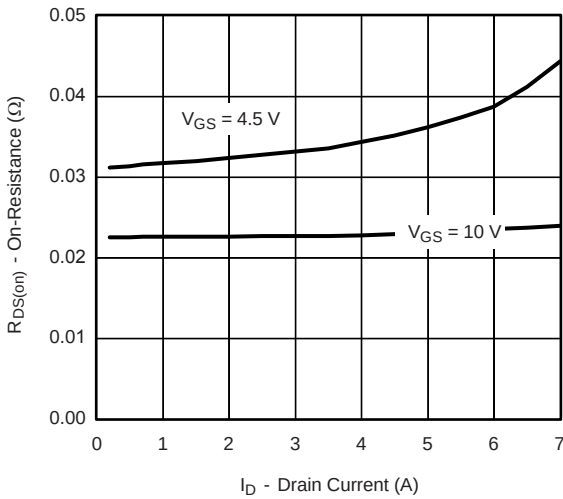
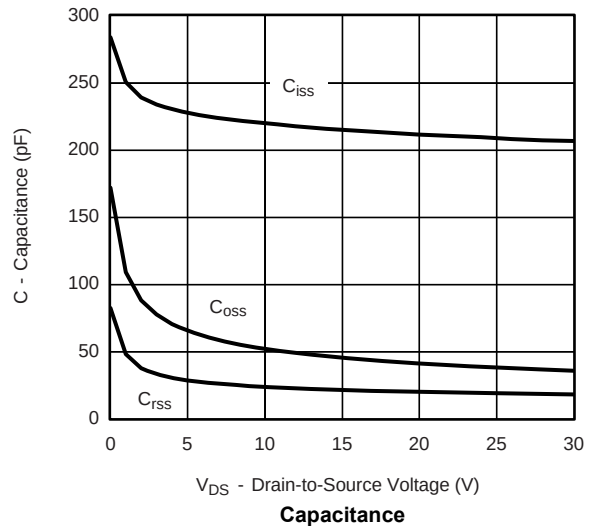
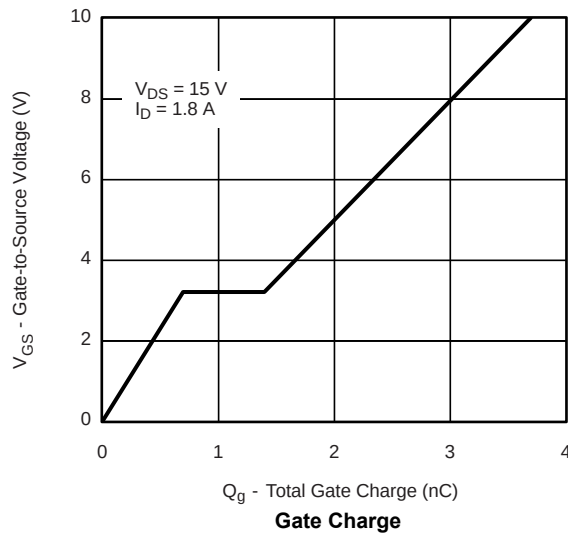
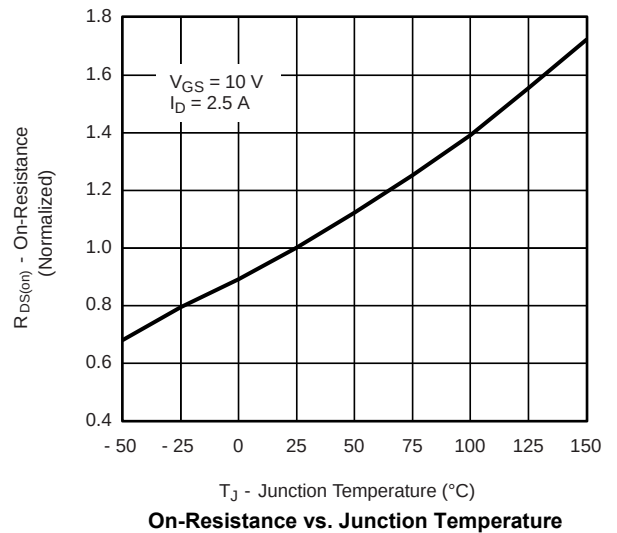
| SPECIFICATIONS T <sub>J</sub> = 25 °C, unless otherwise noted |                     |                                                                                                                                   |                                                                                                                                         |              |            |                |      |          |
|---------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------|------------|----------------|------|----------|
| Parameter                                                     | Symbol              | Test Conditions                                                                                                                   |                                                                                                                                         | Min.         | Typ.       | Max.           | Unit |          |
| Static                                                        |                     |                                                                                                                                   |                                                                                                                                         |              |            |                |      |          |
| Gate Threshold Voltage                                        | V <sub>GS(th)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                                       | N-Ch                                                                                                                                    | 0.5          | 0.8        | 1.5            | V    |          |
|                                                               |                     | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA                                                                     | P-Ch                                                                                                                                    | - 0.5        | -0.8       | -1.5           |      |          |
| Gate-Body Leakage                                             | I <sub>GSS</sub>    | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 8 V                                                                                    | N-Ch<br>P-Ch                                                                                                                            |              |            | ± 100<br>± 100 | nA   |          |
| Zero Gate Voltage Drain Current                               | I <sub>DSS</sub>    | V <sub>DS</sub> = 16 V, V <sub>GS</sub> = 0 V                                                                                     | N-Ch                                                                                                                                    |              |            | 1              | μA   |          |
|                                                               |                     | V <sub>DS</sub> = - 16 V, V <sub>GS</sub> = 0 V                                                                                   | P-Ch                                                                                                                                    |              |            | - 1            |      |          |
|                                                               |                     | V <sub>DS</sub> = 16 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C                                                             | N-Ch                                                                                                                                    |              |            | 5              |      |          |
|                                                               |                     | V <sub>DS</sub> = - 16 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C                                                           | P-Ch                                                                                                                                    |              |            | - 5            |      |          |
| On-State Drain Current <sup>a</sup>                           | I <sub>D(on)</sub>  | V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 10 V                                                                                     | N-Ch                                                                                                                                    | 3.7          |            |                | A    |          |
|                                                               |                     | V <sub>DS</sub> = - 5 V, V <sub>GS</sub> = - 10 V                                                                                 | P-Ch                                                                                                                                    | - 3          |            |                |      |          |
| Drain-Source On-State Resistance <sup>a</sup>                 | R <sub>DS(on)</sub> | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2.5 A                                                                                    | N-Ch                                                                                                                                    |              | 0.022      |                | Ω    |          |
|                                                               |                     | V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 1.8 A                                                                                | P-Ch                                                                                                                                    |              | 0.055      |                |      |          |
|                                                               |                     | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 2.0 A                                                                                   | N-Ch                                                                                                                                    |              | 0.030      |                |      |          |
|                                                               |                     | V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 1.2 A                                                                               | P-Ch                                                                                                                                    |              | 0.079      |                |      |          |
| Forward Transconductance <sup>a</sup>                         | g <sub>fs</sub>     | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 2.5 A                                                                                    | N-Ch                                                                                                                                    |              | 4.3        |                | S    |          |
|                                                               |                     | V <sub>DS</sub> = - 15 V, I <sub>D</sub> = - 1.8 A                                                                                | P-Ch                                                                                                                                    |              | 2.4        |                |      |          |
| Diode Forward Voltage <sup>a</sup>                            | V <sub>SD</sub>     | I <sub>S</sub> = 1.05 A, V <sub>GS</sub> = 0 V                                                                                    | N-Ch                                                                                                                                    |              | 0.81       | 1.10           | V    |          |
|                                                               |                     | I <sub>S</sub> = - 1.05 A, V <sub>GS</sub> = 0 V                                                                                  | P-Ch                                                                                                                                    |              | - 0.83     | - 1.10         |      |          |
| Dynamic <sup>b</sup>                                          |                     |                                                                                                                                   |                                                                                                                                         |              |            |                |      |          |
| Total Gate Charge                                             | Q <sub>g</sub>      | N-Channel<br>V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 1.8 A                                                | N-Ch<br>P-Ch                                                                                                                            |              | 2.1<br>2.4 | 3.2<br>3.6     | nC   |          |
| Gate-Source Charge                                            | Q <sub>gs</sub>     |                                                                                                                                   | N-Ch<br>P-Ch                                                                                                                            |              | 0.7<br>0.9 |                |      |          |
| Gate-Drain Charge                                             | Q <sub>gd</sub>     | P-Channel<br>V <sub>DS</sub> = - 15 V, V <sub>GS</sub> = - 5 V, I <sub>D</sub> = - 1.8 A                                          | N-Ch<br>P-Ch                                                                                                                            |              | 0.7<br>0.8 |                |      |          |
| Gate Resistance                                               | R <sub>g</sub>      |                                                                                                                                   | N-Ch<br>P-Ch                                                                                                                            | 0.5<br>3     |            | 2.4<br>11      | Ω    |          |
| Turn-On Delay Time                                            | t <sub>d(on)</sub>  | N-Channel<br>V <sub>DD</sub> = 15 V, R <sub>L</sub> = 15 Ω<br>I <sub>D</sub> ≅ 1 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 6 Ω | N-Ch<br>P-Ch                                                                                                                            |              | 7<br>8     | 11<br>12       | ns   |          |
| Rise Time                                                     | t <sub>r</sub>      |                                                                                                                                   | N-Ch<br>P-Ch                                                                                                                            |              | 9<br>12    | 14<br>18       |      |          |
| Turn-Off Delay Time                                           | t <sub>d(off)</sub> |                                                                                                                                   | P-Channel<br>V <sub>DD</sub> = - 15 V, R <sub>L</sub> = 15 Ω<br>I <sub>D</sub> ≅ - 1 A, V <sub>GEN</sub> = - 10 V, R <sub>g</sub> = 6 Ω | N-Ch<br>P-Ch |            | 13<br>12       |      | 20<br>18 |
|                                                               |                     |                                                                                                                                   |                                                                                                                                         | N-Ch<br>P-Ch |            | 5<br>7         |      | 8<br>11  |
| Fall Time                                                     | t <sub>f</sub>      |                                                                                                                                   |                                                                                                                                         |              |            |                |      |          |
| Source-Drain Reverse Recovery Time                            | t <sub>rr</sub>     | I <sub>F</sub> = 1.05 A, dI/dt = 100 A/μs                                                                                         | N-Ch                                                                                                                                    |              | 35         | 60             |      |          |
|                                                               |                     | I <sub>F</sub> = - 1.05 A, dI/dt = 100 A/μs                                                                                       | P-Ch                                                                                                                                    |              | 30         | 60             |      |          |

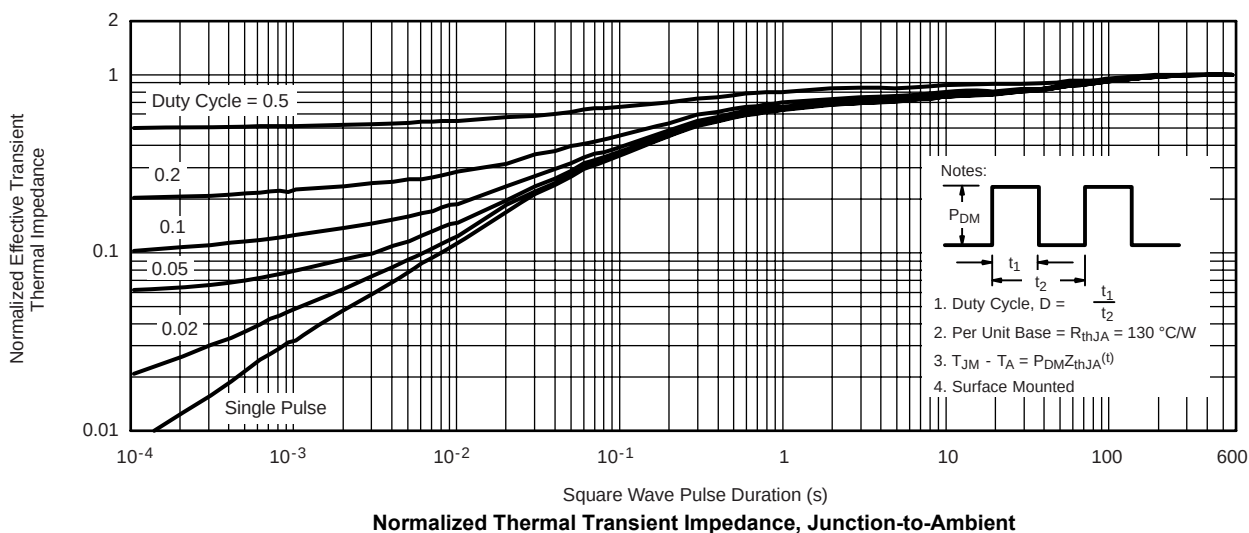
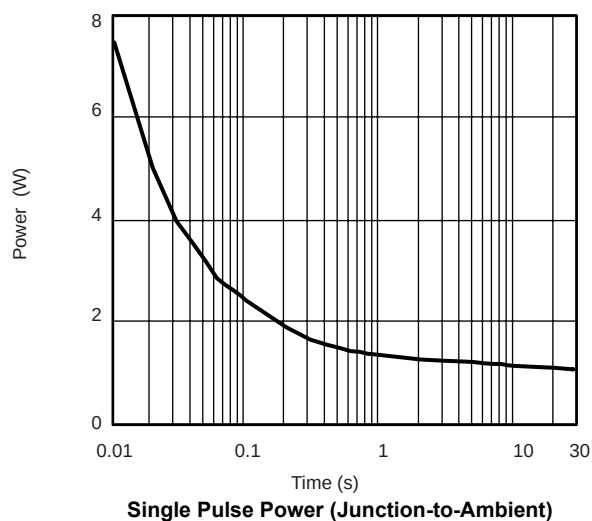
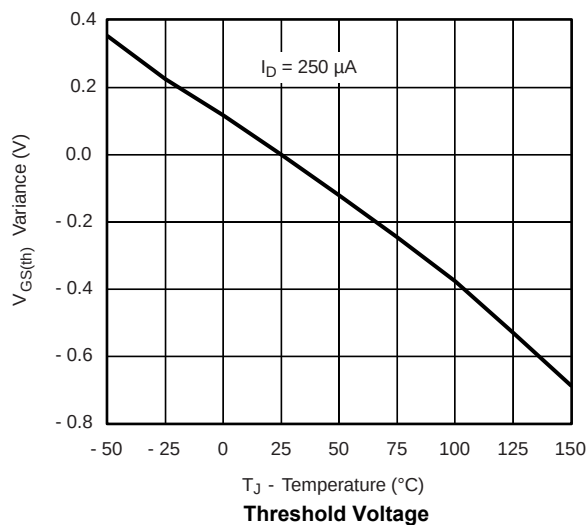
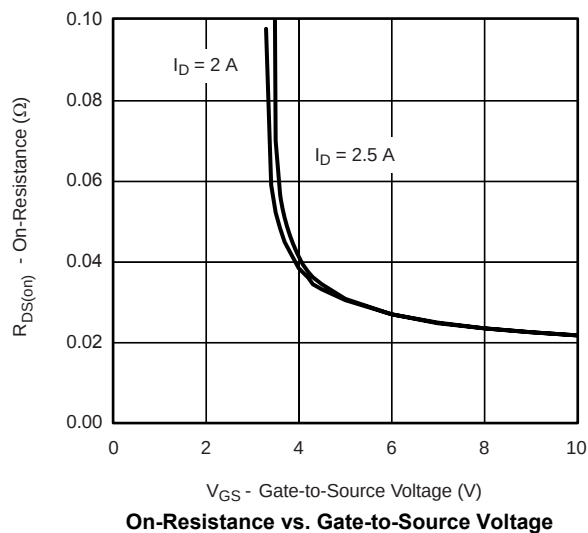
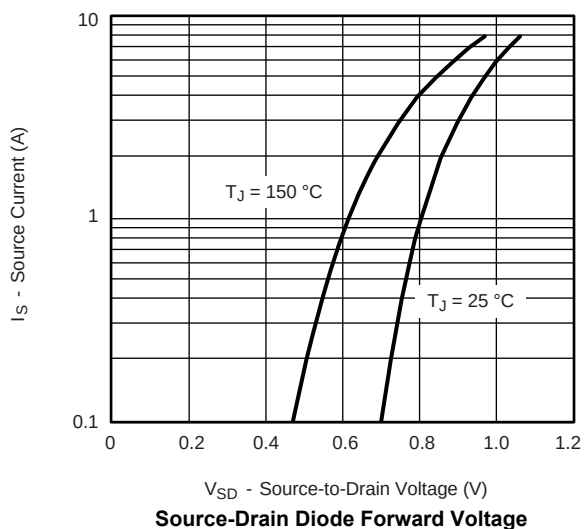
Notes:

a. Pulse test; pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

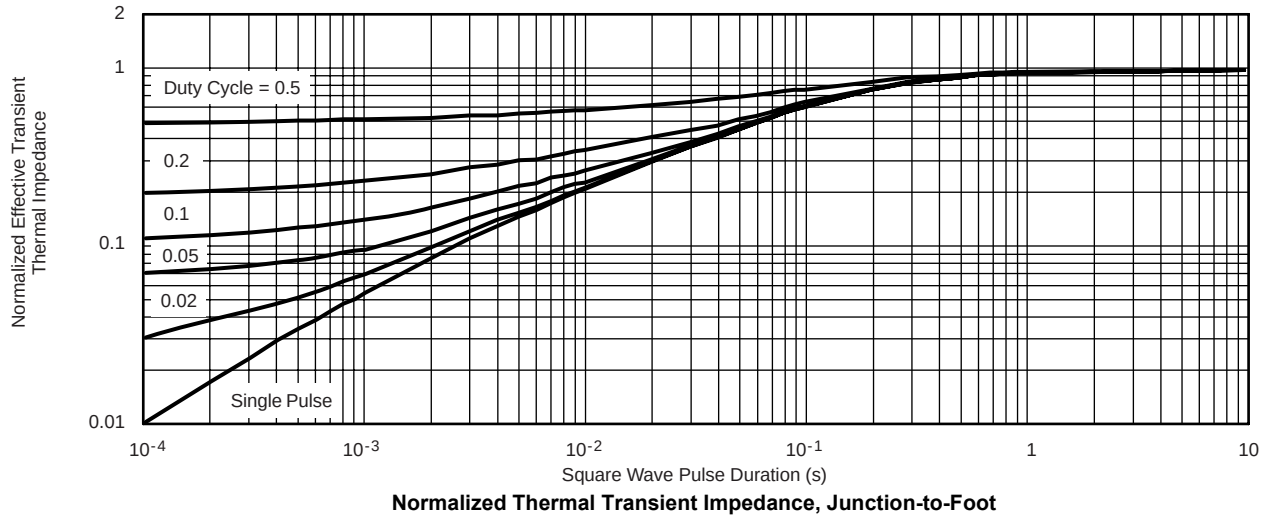
b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

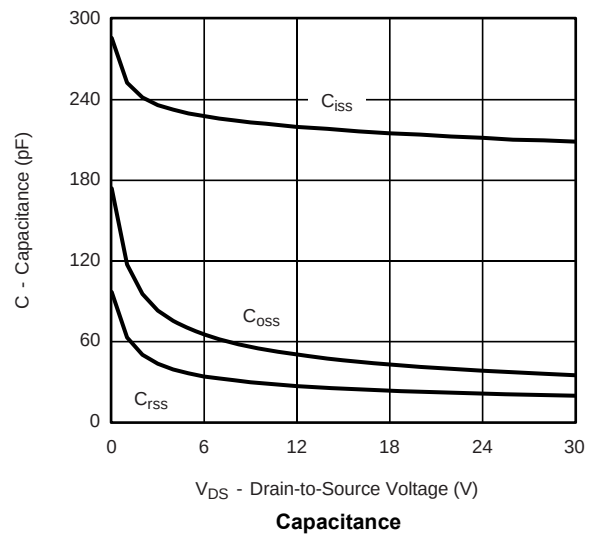
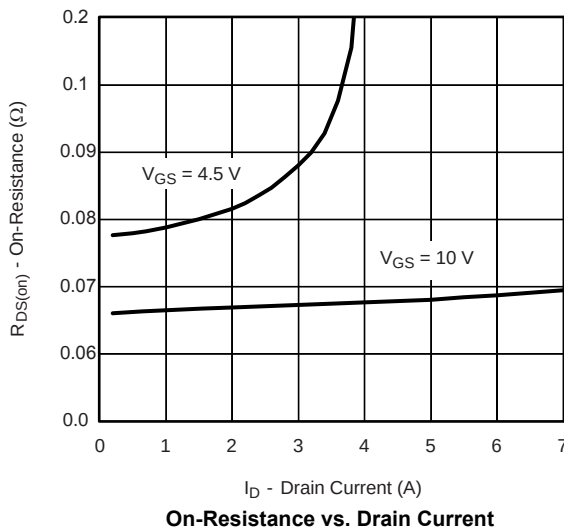
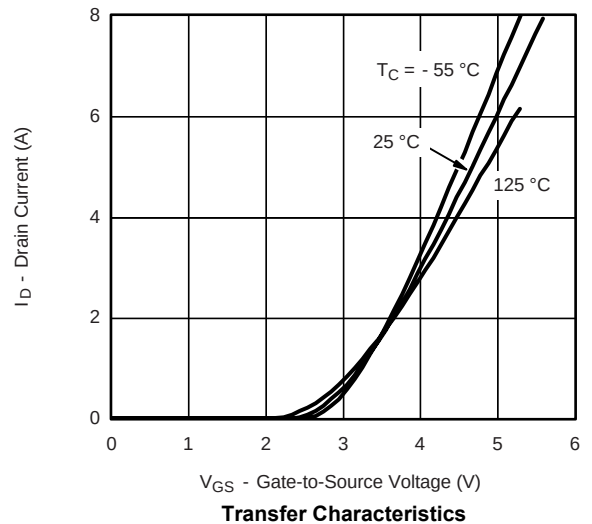
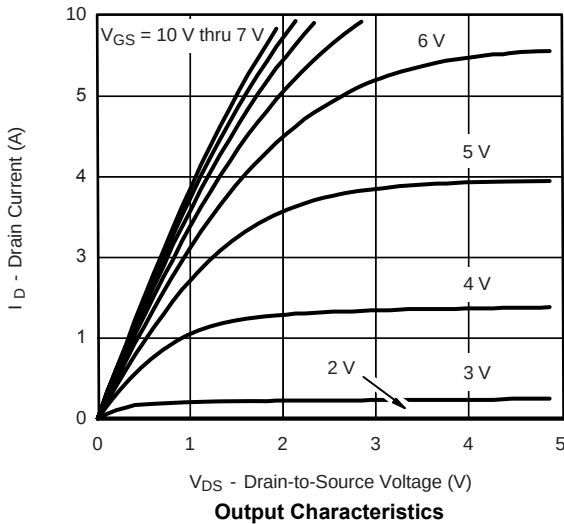
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Output Characteristics**

**Transfer Characteristics**

**On-Resistance vs. Drain Current**

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted


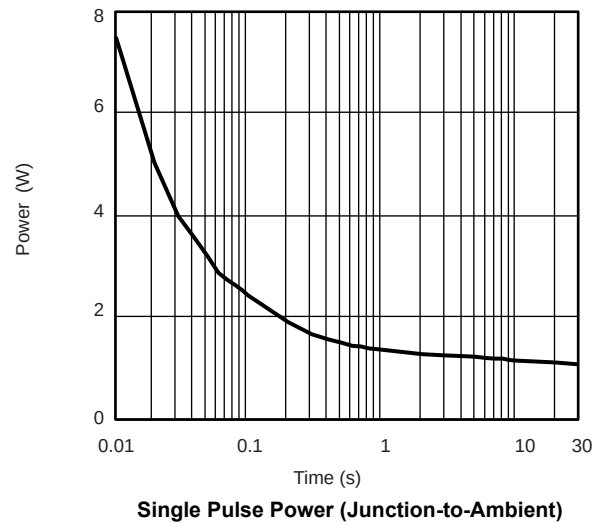
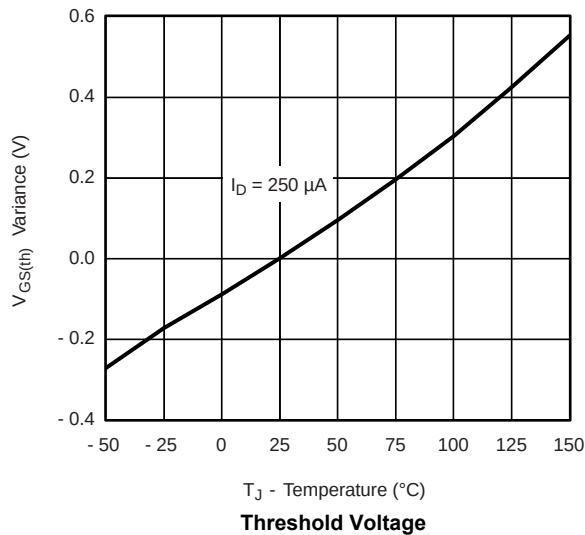
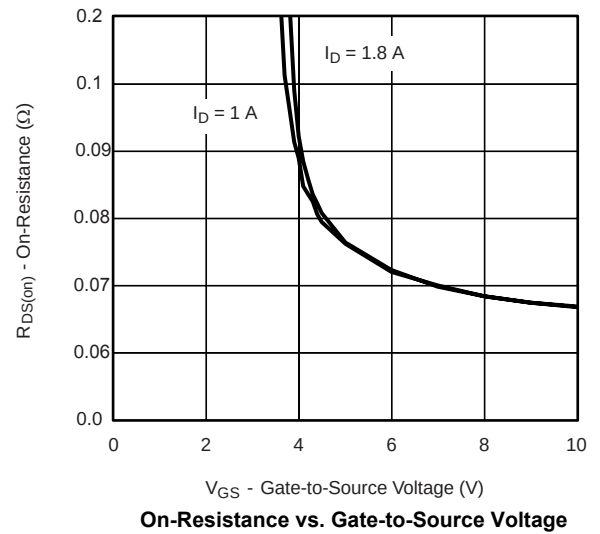
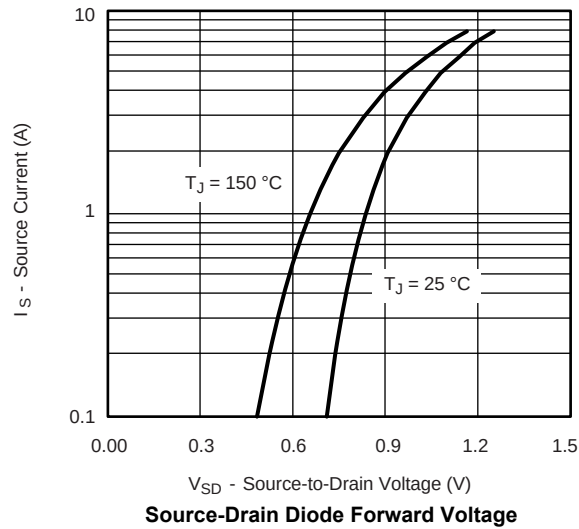
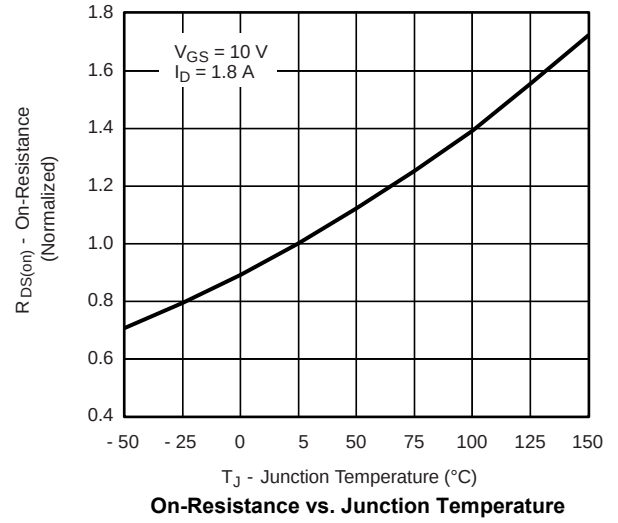
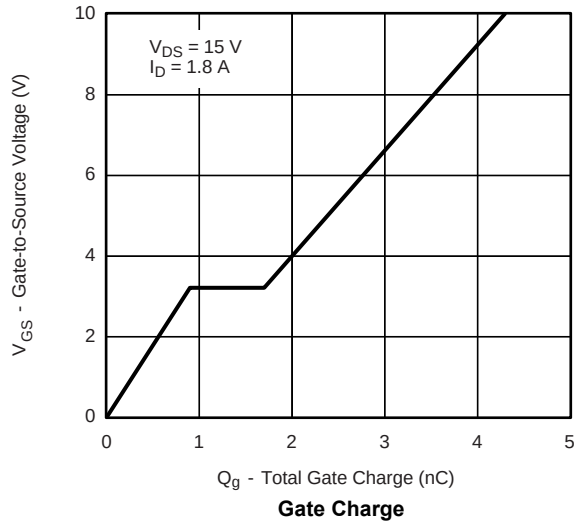
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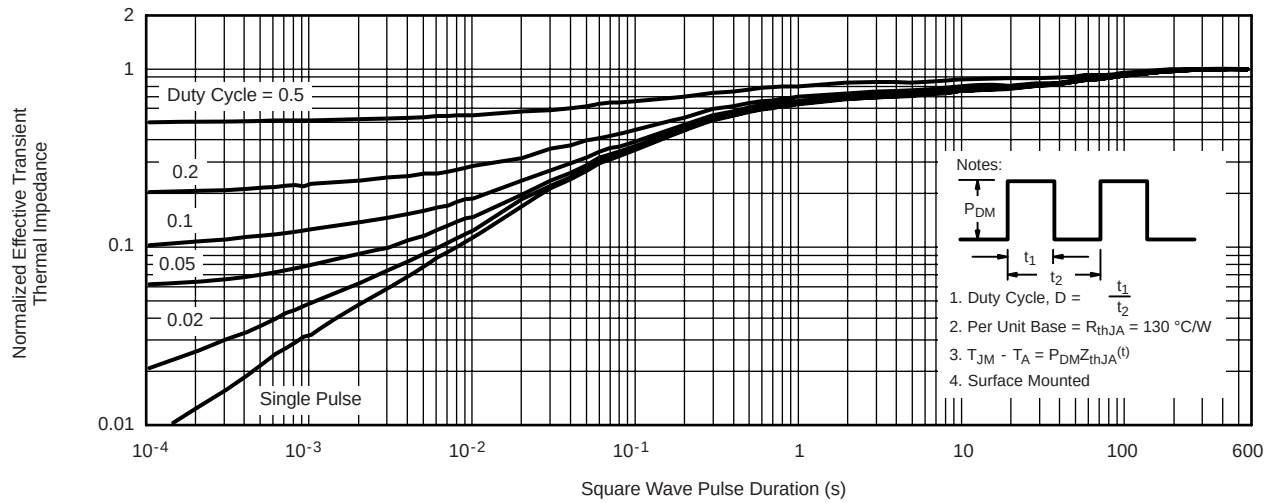
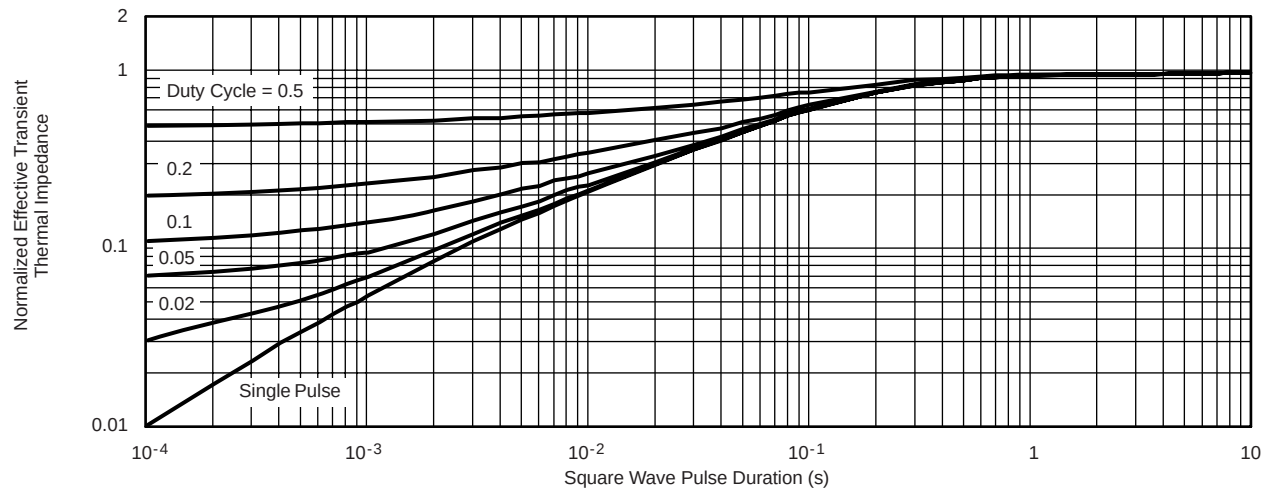


**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



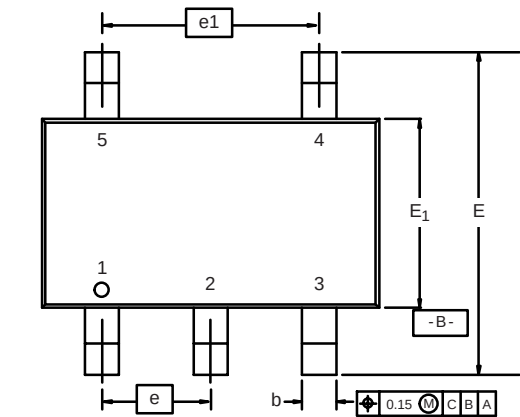
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



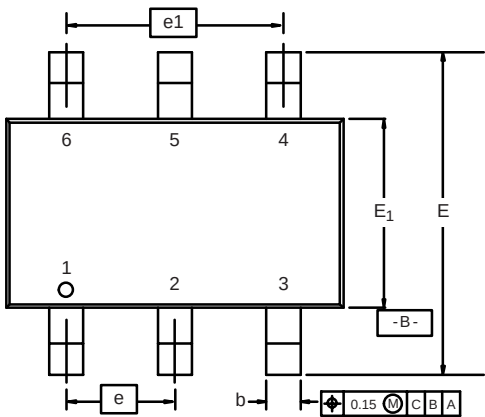
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Normalized Thermal Transient Impedance, Junction-to-Ambient**

**Normalized Thermal Transient Impedance, Junction-to-Foot**

**TSOP: 5/6-LEAD**

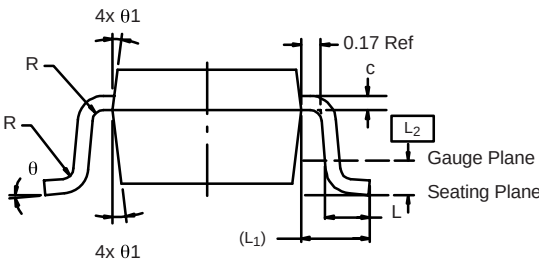
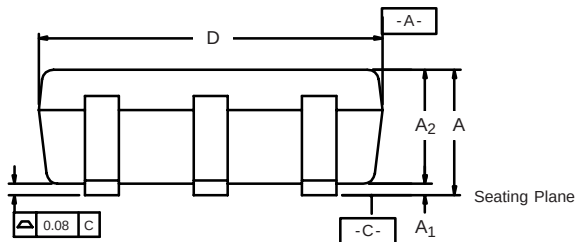
JEDEC Part Number: MO-193C



**5-LEAD TSOP**



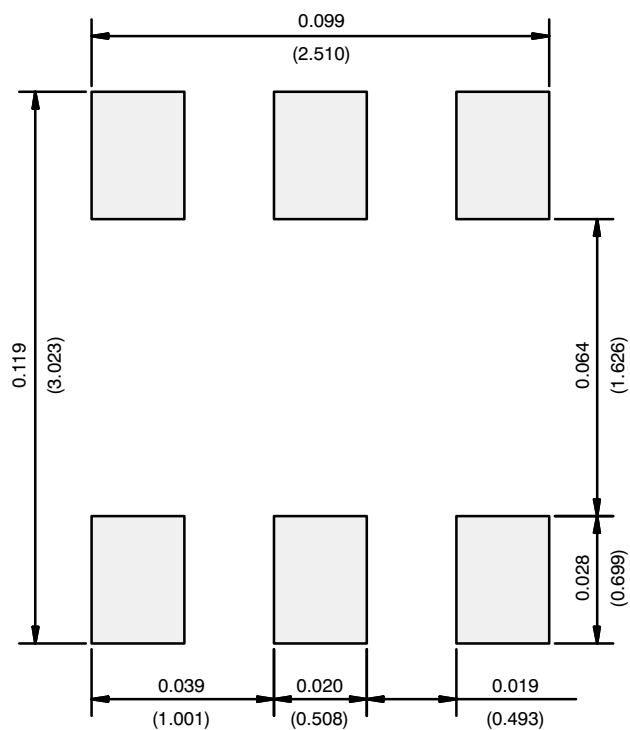
**6-LEAD TSOP**



| Dim                            | MILLIMETERS |      |      | INCHES     |       |       |
|--------------------------------|-------------|------|------|------------|-------|-------|
|                                | Min         | Nom  | Max  | Min        | Nom   | Max   |
| A                              | 0.91        | -    | 1.10 | 0.036      | -     | 0.043 |
| A <sub>1</sub>                 | 0.01        | -    | 0.10 | 0.0004     | -     | 0.004 |
| A <sub>2</sub>                 | 0.90        | -    | 1.00 | 0.035      | 0.038 | 0.039 |
| b                              | 0.30        | 0.32 | 0.45 | 0.012      | 0.013 | 0.018 |
| c                              | 0.10        | 0.15 | 0.20 | 0.004      | 0.006 | 0.008 |
| D                              | 2.95        | 3.05 | 3.10 | 0.116      | 0.120 | 0.122 |
| E                              | 2.70        | 2.85 | 2.98 | 0.106      | 0.112 | 0.117 |
| E <sub>1</sub>                 | 1.55        | 1.65 | 1.70 | 0.061      | 0.065 | 0.067 |
| e                              | 0.95 BSC    |      |      | 0.0374 BSC |       |       |
| e <sub>1</sub>                 | 1.80        | 1.90 | 2.00 | 0.071      | 0.075 | 0.079 |
| L                              | 0.32        | -    | 0.50 | 0.012      | -     | 0.020 |
| L <sub>1</sub>                 | 0.60 Ref    |      |      | 0.024 Ref  |       |       |
| L <sub>2</sub>                 | 0.25 BSC    |      |      | 0.010 BSC  |       |       |
| R                              | 0.10        | -    | -    | 0.004      | -     | -     |
| θ                              | 0°          | 4°   | 8°   | 0°         | 4°    | 8°    |
| θ <sub>1</sub>                 | 7° Nom      |      |      | 7° Nom     |       |       |
| ECN: C-06593-Rev. I, 18-Dec-06 |             |      |      |            |       |       |
| DWG: 5540                      |             |      |      |            |       |       |



## RECOMMENDED MINIMUM PADS FOR TSOP-6



Recommended Minimum Pads  
Dimensions in Inches/(mm)

# Disclaimer

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