Complementary 20 V (D-S) Low-Threshold MOSFET

FEATURES
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFETs: 1.8 V Rated
- Thermally Enhanced SC-70 Package
- Fast Switching
- Compliant to RoHS Directive 2002/95/EC

APPLICATIONS
- Load Switch for Portable Devices

PRODUCT SUMMARY

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>RDSON (Ω)</th>
<th>ID (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-Channel</td>
<td>20</td>
<td>0.280 at VGS = 4.5 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.360 at VGS = 2.5 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.450 at VGS = 1.8 V</td>
</tr>
<tr>
<td>P-Channel</td>
<td>-20</td>
<td>0.490 at VGS = -4.5 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.750 at VGS = -2.5 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.10 at VGS = -1.8 V</td>
</tr>
</tbody>
</table>

ABSOLUTE MAXIMUM RATINGS

TA = 25 °C, unless otherwise noted

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>N-Channel</th>
<th>P-Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Voltage</td>
<td>VDS</td>
<td>20</td>
<td>-20</td>
</tr>
<tr>
<td>Gate-Source Voltage</td>
<td>VGS</td>
<td>±8</td>
<td>±8</td>
</tr>
<tr>
<td>Continuous Drain Current (TJ = 150 °C)*</td>
<td>ID</td>
<td>1.28</td>
<td>1.13</td>
</tr>
<tr>
<td>TJA = 25 °C</td>
<td></td>
<td>-1.00</td>
<td>-0.88</td>
</tr>
<tr>
<td>TJA = 85 °C</td>
<td></td>
<td>0.92</td>
<td>0.81</td>
</tr>
<tr>
<td>Pulsed Drain Current</td>
<td>IDM</td>
<td>4.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Continuous Source Current (Diode Conduction)*</td>
<td>IS</td>
<td>0.61</td>
<td>0.48</td>
</tr>
<tr>
<td>TJA = 25 °C</td>
<td></td>
<td>-0.61</td>
<td>-0.48</td>
</tr>
<tr>
<td>TJA = 85 °C</td>
<td></td>
<td>0.74</td>
<td>0.57</td>
</tr>
<tr>
<td>Maximum Power Dissipation*</td>
<td>PD</td>
<td>0.38</td>
<td>0.30</td>
</tr>
<tr>
<td>TJA = 25 °C</td>
<td></td>
<td>0.16</td>
<td>0.3</td>
</tr>
<tr>
<td>TJA = 85 °C</td>
<td></td>
<td>0.74</td>
<td>0.57</td>
</tr>
<tr>
<td>Operating Junction and Storage Temperature Range</td>
<td>TJ, Tstg</td>
<td>-55 to 150 °C</td>
<td></td>
</tr>
</tbody>
</table>

THERMAL RESISTANCE RATINGS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Typical</th>
<th>Maximum</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Junction-to-Ambient*</td>
<td>RJA</td>
<td>130</td>
<td>170</td>
<td>°C/W</td>
</tr>
<tr>
<td>Steady State</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Junction-to-Foot (Drain)</td>
<td>RJF</td>
<td>170</td>
<td>220</td>
<td>°C/W</td>
</tr>
<tr>
<td>Steady State</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
a. Surface mounted on 1” x 1” FR4 board.
### SPECIFICATIONS  \( T_J = 25^\circ C, \) unless otherwise noted

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Static</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate Threshold Voltage</td>
<td>( V_{GS(th)} )</td>
<td>( V_{DS} = V_{GS}, I_D = 100 \mu A )</td>
<td>N-Ch</td>
<td>0.45</td>
<td>1</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DS} = V_{GS}, I_D = - 100 \mu A )</td>
<td>P-Ch</td>
<td>- 0.45</td>
<td>1</td>
<td>V</td>
</tr>
<tr>
<td>Gate-Body Leakage</td>
<td>( I_{GSS} )</td>
<td>( V_{DS} = 0 \ V, V_{GS} = \pm 8 \ V )</td>
<td>N-Ch</td>
<td></td>
<td>( \pm 100 )</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DS} = 16 \ V, V_{GS} = 0 \ V )</td>
<td>P-Ch</td>
<td></td>
<td>1</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DS} = 16 \ V, V_{GS} = 0 \ V )</td>
<td>N-Ch</td>
<td></td>
<td>1</td>
<td>nA</td>
</tr>
<tr>
<td>Zero Gate Voltage Drain Current</td>
<td>( I_{DSS} )</td>
<td>( V_{DS} = 16 \ V, V_{GS} = 0 \ V, T_J = 85^\circ C )</td>
<td>N-Ch</td>
<td>5</td>
<td>- 5</td>
<td>µA</td>
</tr>
<tr>
<td>On-State Drain Current(^a)</td>
<td>( I_{D(on)} )</td>
<td>( V_{DS} \geq 5 \ V, V_{GS} = 4.5 \ V )</td>
<td>N-Ch</td>
<td>2</td>
<td>- 2</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DS} \leq - 5 \ V, V_{GS} = - 4.5 \ V )</td>
<td>P-Ch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drain-Source On-State Resistance(^a)</td>
<td>( R_{DS(on)} )</td>
<td>( V_{GS} = 4.5 \ V, I_D = 1.13 \ A )</td>
<td>N-Ch</td>
<td>0.220</td>
<td>0.280</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{GS} = - 4.5 \ V, I_D = - 0.88 \ A )</td>
<td>P-Ch</td>
<td>0.400</td>
<td>0.490</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{GS} = 2.5 \ V, I_D = 0.99 \ A )</td>
<td>N-Ch</td>
<td>0.281</td>
<td>0.360</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{GS} = - 2.5 \ V, I_D = - 0.71 \ A )</td>
<td>P-Ch</td>
<td>0.610</td>
<td>0.750</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{GS} = 1.8 \ V, I_D = 0.20 \ A )</td>
<td>N-Ch</td>
<td>0.344</td>
<td>0.450</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{GS} = - 1.8 \ V, I_D = - 0.20 \ A )</td>
<td>P-Ch</td>
<td>0.850</td>
<td>1.10</td>
<td>Ω</td>
</tr>
<tr>
<td>Forward Transconductance(^a)</td>
<td>( g_{fs} )</td>
<td>( V_{GS} = 10 \ V, I_D = 1.13 \ A )</td>
<td>N-Ch</td>
<td>2.6</td>
<td></td>
<td>S</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{GS} = - 10 \ V, I_D = - 0.88 \ A )</td>
<td>P-Ch</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diode Forward Voltage(^a)</td>
<td>( V_{SD} )</td>
<td>( I_S = 0.48 \ A, V_{GS} = 0 \ V )</td>
<td>N-Ch</td>
<td>0.8</td>
<td>1.2</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_S = - 0.48 \ A, V_{GS} = 0 \ V )</td>
<td>P-Ch</td>
<td>- 0.8</td>
<td>- 1.2</td>
<td></td>
</tr>
<tr>
<td><strong>Dynamic(^b)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Gate Charge</td>
<td>( Q_g )</td>
<td>( V_{DS} = 10 \ V, V_{GS} = 4.5 \ V, I_D = 1.13 \ A )</td>
<td>N-Ch</td>
<td>1.25</td>
<td>2</td>
<td>nC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>P-Ch</td>
<td>1.2</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Gate-Source Charge</td>
<td>( Q_{gs} )</td>
<td>( V_{DS} = 10 \ V, V_{GS} = - 0.88 \ A )</td>
<td>N-Ch</td>
<td>0.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>P-Ch</td>
<td>0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate-Drain Charge</td>
<td>( Q_{gd} )</td>
<td>( V_{DS} = - 10 \ V, V_{GS} = - 4.5 \ V, I_D = - 0.88 \ A )</td>
<td>N-Ch</td>
<td>0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>P-Ch</td>
<td>0.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn-On Delay Time</td>
<td>( t_{d(on)} )</td>
<td>( V_{DD} = 10 \ V, R_L = 20 \ \Omega )</td>
<td>N-Ch</td>
<td>15</td>
<td>25</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_D = 0.5 \ A, V_{GEN} = 4.5 \ V, R_g = 6 \ \Omega )</td>
<td>P-Ch</td>
<td>18</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Rise Time</td>
<td>( t_r )</td>
<td>( V_{DD} = 10 \ V, R_L = 20 \ \Omega )</td>
<td>N-Ch</td>
<td>22</td>
<td>35</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_D = 0.5 \ A, V_{GEN} = 4.5 \ V, R_g = 6 \ \Omega )</td>
<td>P-Ch</td>
<td>25</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Turn-Off Delay Time</td>
<td>( t_{d(off)} )</td>
<td>( V_{DD} = - 10 \ V, R_L = 20 \ \Omega )</td>
<td>N-Ch</td>
<td>25</td>
<td>40</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_D = - 0.5 \ A, V_{GEN} = - 4.5 \ V, R_g = 6 \ \Omega )</td>
<td>P-Ch</td>
<td>15</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Fall Time</td>
<td>( t_f )</td>
<td>( V_{DD} = 10 \ V, R_L = 20 \ \Omega )</td>
<td>N-Ch</td>
<td>12</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_D = 0.5 \ A, V_{GEN} = 4.5 \ V, R_g = 6 \ \Omega )</td>
<td>P-Ch</td>
<td>12</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Reverse Recovery Time</td>
<td>( t_{rr} )</td>
<td>( I_F = 0.48 \ A, dI/dt = 100 \ A/\mu s )</td>
<td>N-Ch</td>
<td>30</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>P-Ch</td>
<td>30</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
- \(^a\) Pulse test; pulse width \( \leq 300 \ \mu s \), 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

- On-Resistance vs. Drain Current
- Gate Charge

Transfer Characteristics

- On-Resistance vs. Drain Current
- Gate-to-Source Voltage (V)

Capacitance

- On-Resistance vs. Drain Current
- Drain-to-Source Voltage (V)

Gate Charge

- On-Resistance vs. Junction Temperature
- Total Gate Charge (nC)

On-Resistance vs. Junction Temperature

- Drain Current (A)
- Drain-to-Source Voltage (V)
**Si1563DH**

**Vishay Siliconix**

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

**Source-Drain Diode Forward Voltage**

- **T_J = 150 °C**
- **T_J = 25 °C**

**Threshold Voltage**

- **I_D = 100 µA**

**On-Resistance vs. Gate-to-Source Voltage**

- **I_D = 1.13 A**

**Safe Operating Area, Junction-to-Ambient**

- **V_DS - Drain-to-Source Voltage (V)**
- **I_D - Drain Current (A)**
- **V_GS - Gate-to-Source Voltage (V)**
- **Power (W)**
- **Time (s)**

*V_GS > minimum V_GS at which R_DSOV is specified*
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

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

**Normalized Effective Transient Thermal Impedance**

**Notes:**
1. Duty Cycle, \( D = \frac{t_1}{t_2} \)
2. Per Unit Base = \( R_{thJA} = 170 \) °C/W
3. \( T_{JM} - T_A = P_{DM} Z_{thJA} (t) \)
4. Surface Mounted

**Normalized Thermal Transient Impedance, Junction-to-Foot**
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Output Characteristics

On-Resistance vs. Drain Current

Transfer Characteristics

Capacitance

Gate Charge

On-Resistance vs. Junction Temperature
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Source-Drain Diode Forward Voltage

<table>
<thead>
<tr>
<th>VSD (V)</th>
<th>0.1</th>
<th>0.2</th>
<th>0.4</th>
<th>0.6</th>
<th>0.8</th>
<th>1.0</th>
<th>1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_S (A)</td>
<td>0.1</td>
<td>1.0</td>
<td>1.2</td>
<td>0.1</td>
<td>0.2</td>
<td>0.6</td>
<td>0.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID (µA)</th>
<th>0.0</th>
<th>0.05</th>
<th>0.10</th>
<th>0.15</th>
<th>0.20</th>
<th>0.25</th>
<th>0.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vgs (V)</td>
<td>-0.15</td>
<td>-0.10</td>
<td>-0.05</td>
<td>0.00</td>
<td>0.05</td>
<td>0.10</td>
<td>0.15</td>
</tr>
</tbody>
</table>

On-Resistance vs. Gate-to-Source Voltage

<table>
<thead>
<tr>
<th>VGS (V)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDS(on) (Ω)</td>
<td>1.6</td>
<td>1.2</td>
<td>0.8</td>
<td>0.4</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Safe Operating Area, Junction-to-Ambient

<table>
<thead>
<tr>
<th>ID (mA)</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDS (V)</td>
<td>0.01</td>
<td>0.1</td>
<td>1</td>
<td>10</td>
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</tbody>
</table>

* VGS > minimum VGS at which RDS(on) is specified

Single Pulse Power, Junction-to-Ambient

<table>
<thead>
<tr>
<th>ID (mA)</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(t) (W)</td>
<td>0.00001</td>
<td>0.001</td>
<td>0.01</td>
<td>0.1</td>
</tr>
</tbody>
</table>

* VGS > minimum VGS at which RDS(on) is specified

Safe Operating Area, Junction-to-Ambient

* VGS > minimum VGS at which RDS(on) is specified
Si1563DH
Vishay Siliconix

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

![Graphs showing normalized thermal transient impedance for junction-to-ambient and junction-to-foot at 25 °C.](image)

Notes:
1. Duty Cycle, \( D = \frac{t_1}{t_2} \)
2. Per Unit Base: \( R_{thJA} = 170 \, ^\circ\text{C}/\text{W} \)
3. \( T_{JM} - T_A = PDMZ_{thJA}(t) \)
4. Surface Mounted

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