Complementary MOSFET Half-Bridge (N- and P-Channel)

## PRODUCT SUMMARY

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>N-Channel</th>
<th>P-Channel</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Voltage</td>
<td>$V_{DS}$</td>
<td>20</td>
<td>-20</td>
<td>V</td>
</tr>
<tr>
<td>Gate-Source Voltage</td>
<td>$V_{GS}$</td>
<td>±12</td>
<td>±12</td>
<td>V</td>
</tr>
<tr>
<td>Continuous Drain Current (T$_{J}$ = 25°C)</td>
<td>$I_D$</td>
<td>±6.0</td>
<td>±4.5</td>
<td>A</td>
</tr>
<tr>
<td>Continuous Drain Current (T$_{J}$ = 70°C)</td>
<td>$I_D$</td>
<td>±35.5</td>
<td>±20</td>
<td>A</td>
</tr>
<tr>
<td>Pulsed Drain Current</td>
<td>$I_{DM}$</td>
<td>±30</td>
<td>±30</td>
<td>A</td>
</tr>
<tr>
<td>Continuous Source Current (Diode Conduction)</td>
<td>$I_S$</td>
<td>1.7</td>
<td>-1.7</td>
<td>A</td>
</tr>
<tr>
<td>Maximum Power Dissipation</td>
<td>$P_D$</td>
<td>2.5</td>
<td>1.6</td>
<td>W</td>
</tr>
<tr>
<td>Operating Junction and Storage Temperature Range</td>
<td>$T_J$, $T_{Stg}$</td>
<td>-55 to 150</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

### ABSOLUTE MAXIMUM RATINGS (T$_{A}$ = 25°C UNLESS OTHERWISE NOTED)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>N-Channel</th>
<th>P-Channel</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Junction-to-Ambient(a,b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-State</td>
<td></td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-State</td>
<td></td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-State</td>
<td></td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-State</td>
<td></td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-State</td>
<td></td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-State</td>
<td></td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-State</td>
<td></td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-State</td>
<td></td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes</td>
<td></td>
<td>a. Surface Mounted on FR4 Board. b. $t$ ≤ 10 sec</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SPECIFICATIONS (T<sub>J</sub> = 25°C UNLESS OTHERWISE NOTED)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min</th>
<th>Typ&lt;sup&gt;a&lt;/sup&gt;</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 = 250 \mu A )</td>
<td>N-Ch</td>
<td>0.6</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DS} = V_{GS}, I_D = -250 \mu A )</td>
<td>P-Ch</td>
<td>-0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate-Body Leakage</td>
<td>( I_{GSS} )</td>
<td>( V_{DS} = 0 \text{ V}, V_{GS} = \pm 12 \text{ V} )</td>
<td>N-Ch</td>
<td>±100</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DS} = 16 \text{ V}, V_{GS} = 0 \text{ V} )</td>
<td>P-Ch</td>
<td>±100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zero Gate Voltage Drain Current</td>
<td>( I_{DSS} )</td>
<td>( V_{DS} = 16 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 55^\circ \text{C} )</td>
<td>N-Ch</td>
<td>1</td>
<td></td>
<td>( \mu \text{A} )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DS} = -16 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 55^\circ \text{C} )</td>
<td>P-Ch</td>
<td>-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-State Drain Current&lt;sup&gt;b&lt;/sup&gt;</td>
<td>( I_{D(on)} )</td>
<td>( V_{DS} = 5 \text{ V}, V_{GS} = 4.5 \text{ V} )</td>
<td>N-Ch</td>
<td>30</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DS} = -5 \text{ V}, V_{GS} = -4.5 \text{ V} )</td>
<td>P-Ch</td>
<td>-20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drain-Source On-State Resistance&lt;sup&gt;b&lt;/sup&gt;</td>
<td>( r_{DSS(on)} )</td>
<td>( V_{DS} = 4.5 \text{ V}, I_D = 7.0 \text{ A} )</td>
<td>N-Ch</td>
<td>0.022</td>
<td>0.030</td>
<td>( \Omega )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{GS} = -4.5 \text{ V}, I_D = -4.5 \text{ A} )</td>
<td>P-Ch</td>
<td>0.058</td>
<td>0.065</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{GS} = 2.5 \text{ V}, I_D = 6.0 \text{ A} )</td>
<td>N-Ch</td>
<td>0.030</td>
<td>0.040</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{GS} = -2.5 \text{ V}, I_D = -3.5 \text{ A} )</td>
<td>P-Ch</td>
<td>0.087</td>
<td>0.100</td>
<td></td>
</tr>
<tr>
<td>Forward Transconductance&lt;sup&gt;b&lt;/sup&gt;</td>
<td>( g_fs )</td>
<td>( V_{DS} = 15 \text{ V}, I_D = 7.0 \text{ A} )</td>
<td>N-Ch</td>
<td>22</td>
<td></td>
<td>S</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DS} = -15 \text{ V}, I_D = -4.5 \text{ A} )</td>
<td>P-Ch</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diode Forward Voltage&lt;sup&gt;b&lt;/sup&gt;</td>
<td>( V_{SD} )</td>
<td>( I_S = 1.7 \text{ A}, V_{GS} = 0 \text{ V} )</td>
<td>N-Ch</td>
<td>0.70</td>
<td>1.2</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_S = -1.7 \text{ A}, V_{GS} = 0 \text{ V} )</td>
<td>P-Ch</td>
<td>-0.80</td>
<td>-1.2</td>
<td></td>
</tr>
<tr>
<td><strong>Dynamic&lt;sup&gt;a&lt;/sup&gt;</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 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 3.5 \text{ A} )</td>
<td>N-Ch</td>
<td>13</td>
<td>25</td>
<td>nC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DS} = -10 \text{ V}, V_{GS} = -4.5 \text{ V}, I_D = -4.5 \text{ A} )</td>
<td>P-Ch</td>
<td>8.5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Gate-Source Charge</td>
<td>( Q_{gs} )</td>
<td>( V_{DS} = 10 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 3.5 \text{ A} )</td>
<td>N-Ch</td>
<td>3.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DS} = -10 \text{ V}, V_{GS} = -4.5 \text{ V}, I_D = -4.5 \text{ A} )</td>
<td>P-Ch</td>
<td>2.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate-Drain Charge</td>
<td>( Q_{gd} )</td>
<td>( V_{DD} = 10 \text{ V}, R_L = 10 \text{ \Omega} )</td>
<td>N-Ch</td>
<td>3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DD} = -10 \text{ V}, R_L = 10 \text{ \Omega} )</td>
<td>P-Ch</td>
<td>1.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn-On Delay Time</td>
<td>( t_{(on)} )</td>
<td>( V_{DD} = 10 \text{ V}, R_L = 10 \text{ \Omega} )</td>
<td>N-Ch</td>
<td>22</td>
<td>40</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DD} = -10 \text{ V}, R_L = 10 \text{ \Omega} )</td>
<td>P-Ch</td>
<td>15</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Rise Time</td>
<td>( t_r )</td>
<td>( V_{DD} = 10 \text{ V}, R_L = 10 \text{ \Omega} )</td>
<td>N-Ch</td>
<td>40</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DD} = -10 \text{ V}, R_L = 10 \text{ \Omega} )</td>
<td>P-Ch</td>
<td>32</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Turn-Off Delay Time</td>
<td>( t_{(off)} )</td>
<td>( V_{DD} = 10 \text{ V}, R_L = 10 \text{ \Omega} )</td>
<td>N-Ch</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DD} = -10 \text{ V}, R_L = 10 \text{ \Omega} )</td>
<td>P-Ch</td>
<td>57</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Fall Time</td>
<td>( t_f )</td>
<td>( V_{DD} = 10 \text{ V}, R_L = 10 \text{ \Omega} )</td>
<td>N-Ch</td>
<td>20</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DD} = -10 \text{ V}, R_L = 10 \text{ \Omega} )</td>
<td>P-Ch</td>
<td>40</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Source-Drain Reverse Recovery Time</td>
<td>( t_{rr} )</td>
<td>( I_F = 1.7 \text{ A}, \text{di/dt} = 100 \text{ A/\mu s} )</td>
<td>N-Ch</td>
<td>40</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_F = -1.7 \text{ A}, \text{di/dt} = 100 \text{ A/\mu s} )</td>
<td>P-Ch</td>
<td>40</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

Notes
a. Guaranteed by design, not subject to production testing.
b. Pulse test; pulse width ≤ 300 \mu s, duty cycle ≤ 2%.
TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) N-CHANNEL

Output Characteristics
- $V_{DS}$ - Drain-to-Source Voltage (V)
- $I_D$ - Drain Current (A)
- $V_{GS} = 5$ thru 3 V
- $V_{GS} = 2.5$ V
- $V_{GS} = 2$ V
- $V_{GS} = 1.5$ V

Transfer Characteristics
- $V_{GS}$ - Gate-to-Source Voltage (V)
- $I_D$ - Drain Current (A)
- $T_C = 125°C$
- $25°C$
- $-55°C$

On-Resistance vs. Drain Current
- $r_{DS(on)}$ - On-Resistance ($\Omega$)
- $V_{GS} = 2.5$ V
- $V_{GS} = 4.5$ V

Capacitance
- $C$ - Capacitance (pF)
- $C_{oss}$
- $C_{rss}$

Gate Charge
- $V_{GS}$ - Gate-to-Source Voltage (V)
- $Q_g$ - Total Gate Charge (nC)
- $V_{DS} = 10$ V
- $I_D = 4.5$ A

On-Resistance vs. Junction Temperature
- $r_{DS(on)}$ - On-Resistance (Normalized)
- $V_{GS} = 4.5$ V
- $I_D = 4.5$ A
- $T_J$ - Junction Temperature (°C)

Document Number: 70880
S-00269—Rev. A, 26-Apr-99
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**Vishay Siliconix**  
*New Product*

**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)  
N-CHANNEL**

---

### Source-Drain Diode Forward Voltage
![Graph showing Source-Drain Diode Forward Voltage](image)

- **V_S – Source Current (A)**
- **V_SD – Source-Drain Voltage (V)**
- **T_J = 150°C**
- **T_J = 25°C**

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### On-Resistance vs. Gate-to-Source Voltage
![Graph showing On-Resistance vs. Gate-to-Source Voltage](image)

- **ID = 4.5 A**

---

### Threshold Voltage
![Graph showing Threshold Voltage](image)

- **ID = 250 μA**
- **V_SD** – Source-to-Drain Voltage (V)
- **V_GS** – Gate-to-Source Voltage (V)

---

### Single Pulse Power, Junction-To-Ambient
![Graph showing Single Pulse Power, Junction-To-Ambient](image)

- **Power (W)**
- **Time (sec)**

---

### Normalized Thermal Transient Impedance, Junction-to-Ambient
![Graph showing Normalized Thermal Transient Impedance, Junction-to-Ambient](image)

- **Normalized Effective Transient Thermal Impedance**
- **Square Wave Pulse Duration (sec)**

---

**Notes:**
1. Duty Cycle, D = \( \frac{t_1}{t_2} \)
2. Per Unit Base = \( R_{th} = 73 \)°C/W
3. \( T_{JM} - T_A = P_{DM} Z_{th} (t) \)
4. Surface Mounted
**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**

### N-CHANNEL

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

![Normalized Thermal Transient Impedance](image)

**Square Wave Pulse Duration (sec)**

#### Output Characteristics

**On-Resistance vs. Drain Current**

![On-Resistance vs. Drain Current](image)

### P-CHANNEL

#### Transfer Characteristics

**On-Resistance vs. Drain Current**

![On-Resistance vs. Drain Current](image)
TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)  

**Gate Charge**

\[ V_{GS} = \text{Gate-to-Source Voltage (V)} \]

\[ Q_g = \text{Total Gate Charge (nC)} \]

\[ V_{DS} = 10 \text{ V} \]

\[ I_D = 4.4 \text{ A} \]

**On-Resistance vs. Junction Temperature**

\[ R_{DS(on)} = \text{On-Resistance (Ω)} \]

\[ V_{GS} = 4.5 \text{ V} \]

\[ I_D = 4.4 \text{ A} \]

**Source-Drain Diode Forward Voltage**

\[ I_S = \text{Source Current (A)} \]

\[ V_{SD} = \text{Source-to-Drain Voltage (V)} \]

\[ T_J = 150°C \]

\[ T_J = 25°C \]

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

\[ R_{DS(on)} = \text{On-Resistance (Ω)} \]

\[ V_{DS} = 10 \text{ V} \]

\[ I_D = 4.4 \text{ A} \]

**Threshold Voltage**

\[ V_GS(th) = \text{Threshold Voltage (V)} \]

\[ V_{GS} = \text{Gate-to-Source Voltage (V)} \]

\[ T_J = 150°C \]

\[ T_J = 25°C \]

**Single Pulse Power, Junction-To-Ambient**

\[ P = \text{Power (W)} \]

\[ T = \text{Time (sec)} \]

\[ V_{GS} = 4.5 \text{ V} \]

\[ I_D = 4.4 \text{ A} \]
Normalized Thermal Transient Impedance, Junction-to-Ambient

- Duty Cycle = 0.5

Notes:
1. Duty Cycle, \( D = \frac{I_1}{I_2} \)
2. Per Unit Base = \( R_{thJA} = 73 \degree C/W \)
3. \( T_{JA} - T_A = P_{DM} Z_{thJA}(t) \)
4. Surface Mounted

Square Wave Pulse Duration (sec)

Normalized Effective Transient Thermal Impedance

Normalized Thermal Transient Impedance, Junction-to-Foot

- Duty Cycle = 0.5

Square Wave Pulse Duration (sec)
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