The μPA2660T1R is Dual N-channel MOS Field Effect Transistors for switching application. This device features a low on-state resistance and excellent switching characteristics, and is suitable for applications such as power switch of portable machine and so on.

Features

- **DS MAXIMUM RATINGS 20V(T_A = 25°C)**
- 2.5V drive available
- Low on-state resistance
  - \( R_{DS(on)} = 42 \text{ m\(\Omega \)} \text{ MAX.} (V_{GS} = 4.5 \text{ V}, I_D = 2.0 \text{ A}) \)
  - \( R_{DS(on)} = 62 \text{ m\(\Omega \)} \text{ MAX.} (V_{GS} = 2.5 \text{ V}, I_D = 2.0 \text{ A}) \)
- Built-in gate protection diode
- Lead-free and Halogen-free

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>μPA2660T1R-E2-AX***</td>
<td>6pinHUSON2020(Dual)</td>
</tr>
</tbody>
</table>

Note: *1.Pb-free (This product does not contain Pb in the external electrode and other parts.)

Absolute Maximum Ratings (\(T_A = 25^\circ\text{C}\))

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain to Source Voltage ((V_{GS} = 0 \text{ V}))</td>
<td>(V_{DSS})</td>
<td>20</td>
<td>V</td>
</tr>
<tr>
<td>Gate to Source Voltage ((V_{DS} = 0 \text{ V}))</td>
<td>(V_{GSS})</td>
<td>±12</td>
<td>V</td>
</tr>
<tr>
<td>Drain Current (DC)</td>
<td>(I_{D(DC)})</td>
<td>±4.0</td>
<td>A</td>
</tr>
<tr>
<td>Drain Current (pulse)***</td>
<td>(I_{D(pulse)})</td>
<td>±16</td>
<td>A</td>
</tr>
<tr>
<td>Total Power Dissipation (1 unit, 5 s)**</td>
<td>(P_{T1})</td>
<td>1.5</td>
<td>W</td>
</tr>
<tr>
<td>Total Power Dissipation (2 units, 5 s)**</td>
<td>(P_{T2})</td>
<td>2.3</td>
<td>W</td>
</tr>
<tr>
<td>Channel Temperature</td>
<td>(T_{ch})</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>(T_{STG})</td>
<td>–55 to +150</td>
<td>°C</td>
</tr>
</tbody>
</table>

Notes: *1. PW≤10 \(\mu\text{s}\), Duty Cycles≤1%  
*2. Mounted on glass epoxy board of 25.4mm x 25.4mm x 0.8mm

Caution: This product is electrostatic-sensitive device due to low ESD capability and should be handled with caution for electrostatic discharge.

\[ V_{ESD} = \pm 400 \text{V MIN.} \text{ (} C = 100pF, R = 1.5K\Omega \text{) } \]
### Electrical Characteristics (TA = 25°C)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero Gate Voltage Drain Current</td>
<td>I_DSS</td>
<td>1.0</td>
<td>μA</td>
<td></td>
<td></td>
<td>V_DS = 20 V, V_GS = 0 V</td>
</tr>
<tr>
<td>Gate Leakage Current</td>
<td>I_GSS</td>
<td>±10</td>
<td>μA</td>
<td></td>
<td></td>
<td>V_GS = ±10 V, V_DS = 0 V</td>
</tr>
<tr>
<td>Gate Cut-off Voltage</td>
<td>V_GS(off)</td>
<td>0.5</td>
<td></td>
<td>1.5</td>
<td>V</td>
<td>V_DS = 10 V, I_D = 1 mA</td>
</tr>
<tr>
<td>Forward Transfer Admittance**1</td>
<td></td>
<td></td>
<td>5.0</td>
<td></td>
<td></td>
<td>V_DS = 10 V, I_D = 2.0 A</td>
</tr>
<tr>
<td>Drain to Source On-state Resistance**1</td>
<td>R_D(on)1</td>
<td>33</td>
<td>42</td>
<td>mΩ</td>
<td>V_GS = 4.5 V, I_D = 2.0 A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R_D(on)2</td>
<td>43</td>
<td>62</td>
<td>mΩ</td>
<td>V_GS = 2.5 V, I_D = 2.0 A</td>
<td></td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>C_DSS</td>
<td>330</td>
<td></td>
<td>pF</td>
<td>V_DS = 10 V, V_GS = 0 V, f = 1.0 MHz</td>
<td></td>
</tr>
<tr>
<td>Output Capacitance</td>
<td>C_DSS</td>
<td>66</td>
<td></td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse Transfer Capacitance</td>
<td>C_DSS</td>
<td>38</td>
<td></td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn-on Delay Time</td>
<td>t_d(on)</td>
<td>12</td>
<td></td>
<td>ns</td>
<td>I_D = 2.0 A, V_DD = 10 V, V_GS = 4.5 V, R_G = 6 Ω</td>
<td></td>
</tr>
<tr>
<td>Rise Time</td>
<td>t_r</td>
<td>6.4</td>
<td></td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn-off Delay Time</td>
<td>t_d(off)</td>
<td>27</td>
<td></td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall Time</td>
<td>t_f</td>
<td>6.6</td>
<td></td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Gate Charge</td>
<td>Q_G</td>
<td>4.5</td>
<td></td>
<td>nC</td>
<td>I_F = 4.0 A, V_DD = 16 V, V_GS = 10 V</td>
<td></td>
</tr>
<tr>
<td>Gate to Source Charge</td>
<td>Q_GS</td>
<td>1.0</td>
<td></td>
<td>nC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate to Drain Charge</td>
<td>Q_GD</td>
<td>1.5</td>
<td></td>
<td>nC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Diode Forward Voltage**1</td>
<td>V_F(S-D)</td>
<td>1.5</td>
<td></td>
<td>V</td>
<td>I_F = 4.0 A, V_GS = 0 V</td>
<td></td>
</tr>
</tbody>
</table>

Note: **1. Pulsed

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**TEST CIRCUIT 1 SWITCHING TIME**

![TEST CIRCUIT 1 SWITCHING TIME Diagram]

**TEST CIRCUIT 2 GATE CHARGE**

![TEST CIRCUIT 2 GATE CHARGE Diagram]
**Typical Characteristics (T_A = 25°C)**

**DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA**

- **T_A - Ambient Temperature - °C**
- **dT - Percentage of Rated Power - %**
- **0 20 40 60 80 100 120 140**
- **0 25 50 75 100 125 150 175**

**TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE**

- **P_T - Total Power Dissipation - W**
- **V_T - Total Power Dissipation - °C/W**
- **0 20 40 60 80 100 120 140**
- **0 25 50 75 100 125 150 175**

**FORWARD BIAS SAFE OPERATING AREA**

- **I_D - Drain Current - A**
- **0.01 0.1 1 10 100**
- **0.01 0.1 1 10 100**

**TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH**

- **R_{th(t)} - Transient Thermal Resistance - °C/W**
- **0.01 0.1 1 10 100 1000**
- **PW - Pulse Width - s**
- **100 μs 1 m 10 m 100 m 1 s 10 s 100 s 1000 s**

**VDS - Drain to Source Voltage - V**

- Mounted on a glass epoxy board of 25.4 mm x 25.4 mm x 0.8 mm thickness

**Power Dissipation Limited**

- Single Pulse
- PW=5sec

**R_{th(ch-A)}**:

- Single Pulse
- Mounted on a glass epoxy board of 25.4 mm x 25.4 mm x 0.8 mm thickness

**R_{th(ch-A)} = 83.3 °C/W** (1 unit, 5s)

**R_{th(ch-A)} = 54.3 °C/W** (2 units, 5s)
**DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE**

Graph showing the relationship between drain current (I_D) and drain to source voltage (V_DS) with V_GS = 4.5V and 2.5V.

**GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE**

Graph showing the relationship between gate to source cut-off voltage (V_GS(off)) and channel temperature (T_ch) with V_DS = 10V.

**FORWARD TRANSFER CHARACTERISTICS**

Graph showing the relationship between gate to source voltage (V_GS) and drain current (I_D) with V_DS = 10V and Pulsed.

**FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT**

Graph showing the relationship between forward transfer admittance (y_f) and drain current (I_D) with V_DS = 10V and Pulsed.

**DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT**

Graph showing the relationship between drain to source on-state resistance (R_DDS(on)) and drain current (I_D) with Pulsed.

**DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE**

Graph showing the relationship between drain to source on-state resistance (R_DDS(on)) and gate to source voltage (V_GS) with I_D = 2.0A and Pulsed.
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE

CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

SWITCHING CHARACTERISTICS

DYNAMIC INPUT/OUTPUT CHARACTERISTICS

SOURCE TO DRAIN DIODE FORWARD VOLTAGE
Package Drawings (Unit: mm)

6pinHUSON2020

RENESAS Package code: PWSN0006JD-A

Equivalent Circuit

Remark  The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.
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