



# UT9971P

**Power MOSFET**

## 5.0A, 60V N-CHANNEL POWER MOSFET

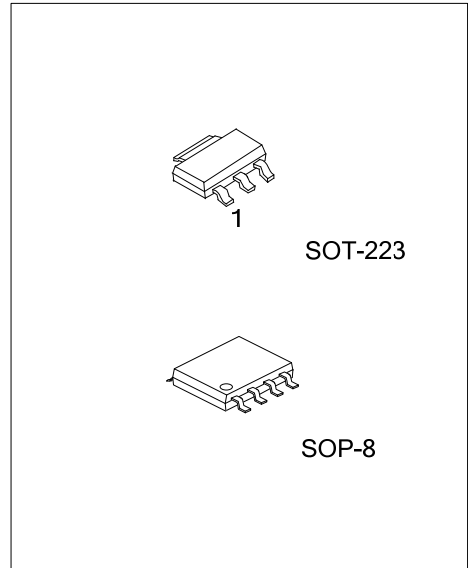
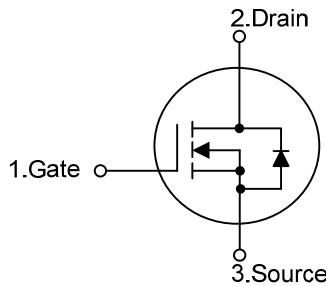
### DESCRIPTION

The UTC **UT9971P** is an N-Channel enhancement mode power MOSFET providing customers with high switching speed, cost-effectiveness and minimum on-state resistance.

### FEATURES

- \*  $R_{DS(ON)} \leq 63 \text{ m}\Omega @ V_{GS}=10\text{V}, I_D=5.0\text{A}$
- $R_{DS(ON)} \leq 86 \text{ m}\Omega @ V_{GS}=4.5\text{V}, I_D=2.5\text{A}$
- \* High switching speed

### SYMBOL



### ORDERING INFORMATION

| Ordering Number |                | Package | Pin Assignment |   |   |   |   |   |   |   | Packing   |
|-----------------|----------------|---------|----------------|---|---|---|---|---|---|---|-----------|
| Lead Free       | Halogen Free   |         | 1              | 2 | 3 | 4 | 5 | 6 | 7 | 8 |           |
| UT9971PL-AA3-R  | UT9971PG-AA3-R | SOT-223 | G              | D | S | - | - | - | - | - | Tape Reel |
| UT9971PL-S08-R  | UT9971PG-S08-R | SOP-8   | S              | S | S | G | D | D | D | D | Tape Reel |

Note: Pin Assignment: G: Gate D: Drain S: Source

|                       |  |
|-----------------------|--|
| <p>UT9971PG-AA3-R</p> | <p>(1) R: Tape Reel</p> <p>(2) AA3: SOT-223, S08: SOP-8</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|-----------------------|--|

### MARKING

| SOT-223 | SOP-8 |
|---------|-------|
|         |       |

■ ABSOLUTE MAXIMUM RATINGS ( $T_A=25^\circ\text{C}$ , unless otherwise specified)

| PARAMETER  |                        | SYMBOL    | RATINGS    | UNIT             |
|--|------------------------|-----------|------------|------------------|
| Drain-Source Voltage                             |                        | $V_{DSS}$ | 60         | V                |
| Gate-Source Voltage                              |                        | $V_{GSS}$ | $\pm 20$   | V                |
| Continuous Drain Current ( $V_{GS}=10\text{V}$ ) |                        | $I_D$     | 5          | A                |
| Pulsed Drain Current (Note 2,3)                  |                        | $I_{DM}$  | 30         | A                |
| Avalanche Energy                                 | Single Pulsed (Note 3) | $E_{AS}$  | 13         | mJ               |
| Power Dissipation                                | SOT-223                | $P_D$     | 2.7        | W                |
|  | SOP-8                  |           | 1.92       | W                |
| Junction Temperature                             |                        | $T_J$     | +150       | $^\circ\text{C}$ |
| Storage Temperature                              |                        | $T_{STG}$ | -55 ~ +150 | $^\circ\text{C}$ |

- Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.  
 2. Repetitive Rating : Pulse width limited by maximum junction temperature.  
 3.  $L=0.1\text{mH}$ ,  $I_{AS}=16.1\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

| PARAMETER           |         | SYMBOL        | RATINGS | UNIT               |
|---------------------|---------|---------------|---------|--------------------|
| Junction to Ambient | SOT-223 | $\theta_{JA}$ | 45      | $^\circ\text{C/W}$ |
|                     | SOP-8   |               | 85      | $^\circ\text{C/W}$ |

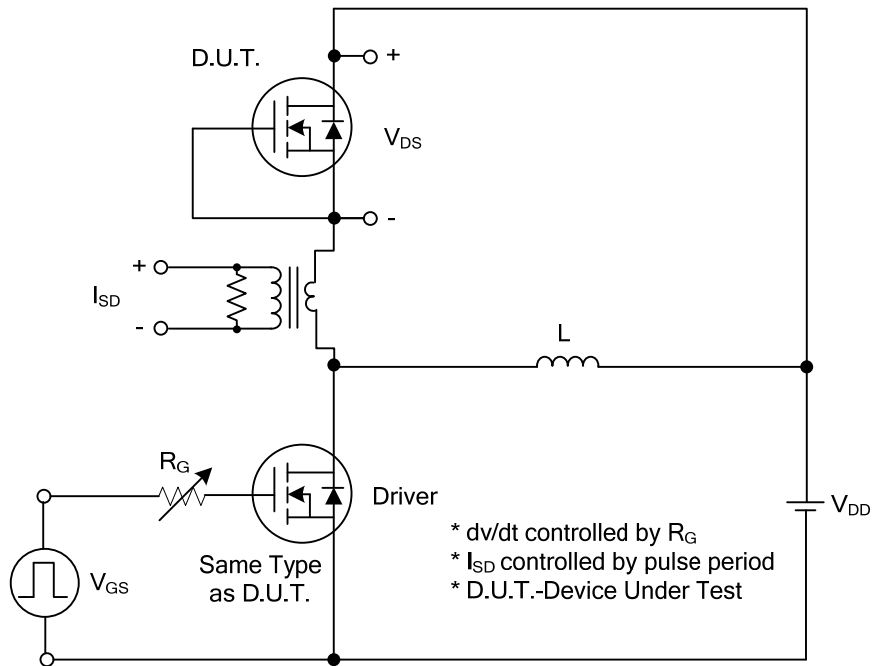
- Notes: 1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.  
 2. The data tested by pulsed, pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .

■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

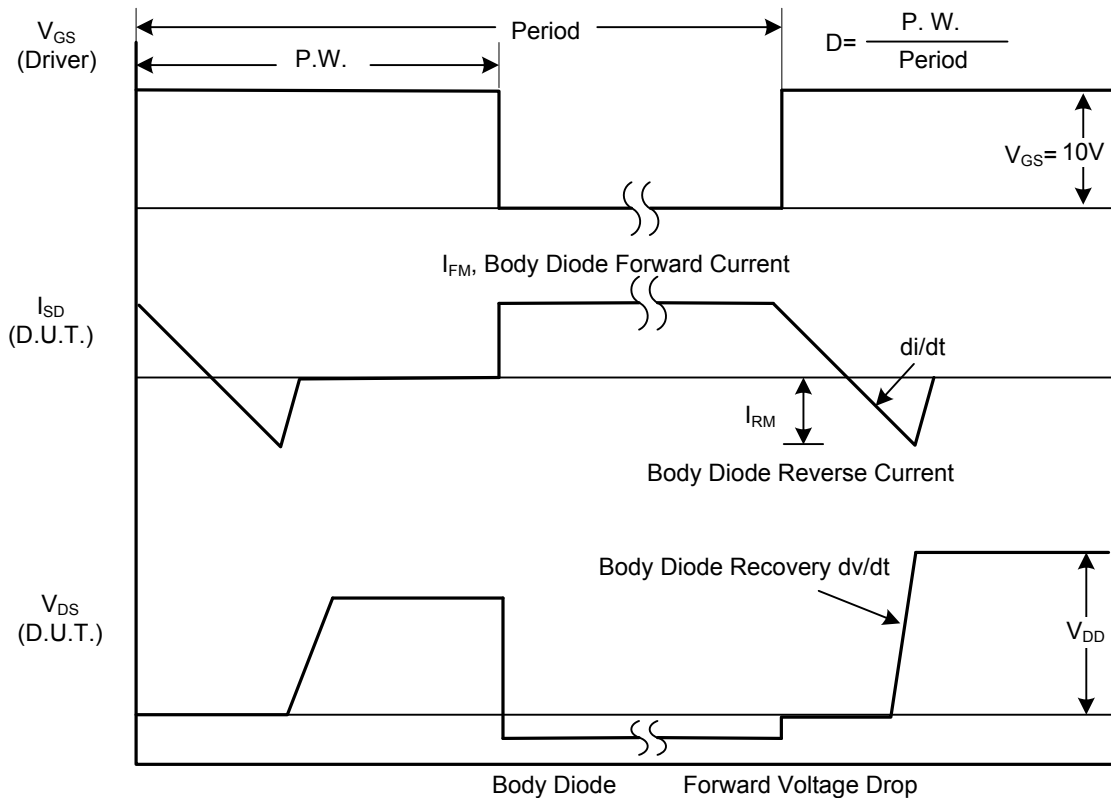
| PARAMETER  | SYMBOL              | TEST CONDITIONS   | MIN | TYP | MAX  | UNIT |
|--|---------------------|---|-----|-----|------|------|
| <b>OFF CHARACTERISTICS</b>                             |                     |   |     |     |      |      |
| Drain-Source Breakdown Voltage                         | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA  | 60  |     |      | V    |
| Zero Gate Voltage Drain Current                        | I <sub>DSS</sub>    | V <sub>DS</sub> =60 V, V <sub>GS</sub> =0V  |     |     | 1    | μA   |
| Gate-Body Leakage Current                              | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V   |     |     | ±100 | nA   |
| <b>ON CHARACTERISTICS</b>                              |                     |   |     |     |      |      |
| Gate Threshold Voltage                                 | V <sub>GS(TH)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA  | 1.0 |     | 3.0  | V    |
| Static Drain-Source On-Resistance (Note)               | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =5.0A  |     |     | 63   | mΩ   |
|  |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =2.5A   |     |     | 86   | mΩ   |
| <b>DYNAMIC PARAMETERS</b>                              |                     |   |     |     |      |      |
| Input Capacitance                                      | C <sub>ISS</sub>    | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz   |     | 620 |      | pF   |
| Output Capacitance                                     | C <sub>OSS</sub>    |   |     | 48  |      | pF   |
| Reverse Transfer Capacitance                           | C <sub>RSS</sub>    |   |     | 36  |      | pF   |
| <b>SWITCHING PARAMETERS</b>                            |                     |   |     |     |      |      |
| Total Gate Charge (Note)                               | Q <sub>G</sub>      | V <sub>DS</sub> =48V, V <sub>GS</sub> =10V, I <sub>D</sub> =5A<br>I <sub>G</sub> =1mA (Note 1, 2)   |     | 16  |      | nC   |
| Gate Source Charge                                     | Q <sub>GS</sub>     |   |     | 2.5 |      | nC   |
| Gate Drain Charge                                      | Q <sub>GD</sub>     |   |     | 2.4 |      | nC   |
| Turn-ON Delay Time (Note)                              | t <sub>D(ON)</sub>  | V <sub>DD</sub> =30V, V <sub>GS</sub> =10V, I <sub>D</sub> =8A,<br>R <sub>G</sub> =3.3Ω (Note 1, 2) |     | 4   |      | ns   |
| Turn-ON Rise Time                                      | t <sub>R</sub>      |   |     | 15  |      | ns   |
| Turn-OFF Delay Time                                    | t <sub>D(OFF)</sub> |   |     | 17  |      | ns   |
| Turn-OFF Fall-Time                                     | t <sub>F</sub>      |   |     | 18  |      | ns   |
| <b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b> |                     |   |     |     |      |      |
| Maximum Continuous Drain-Source Diode Forward Current  | I <sub>S</sub>      |   |     |     | 5    | A    |
| Maximum Pulsed Drain-Source Diode Forward Current      | I <sub>SM</sub>     |   |     |     | 30   | A    |
| Diode Forward Voltage (Note)                           | V <sub>SD</sub>     | I <sub>S</sub> =5.0A, V <sub>GS</sub> =0V   |     |     | 1.2  | V    |
| Body Diode Reverse Recovery Time                       | t <sub>rr</sub>     | I <sub>S</sub> =5.0A, V <sub>GS</sub> =0V,  |     | 40  |      | ns   |
| Body Diode Reverse Recovery Charge                     | Q <sub>rr</sub>     | di/dt=100A/μs   |     | 45  |      | nC   |

Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.  
 2. Essentially independent of operating temperature.

## TEST CIRCUITS AND WAVEFORMS

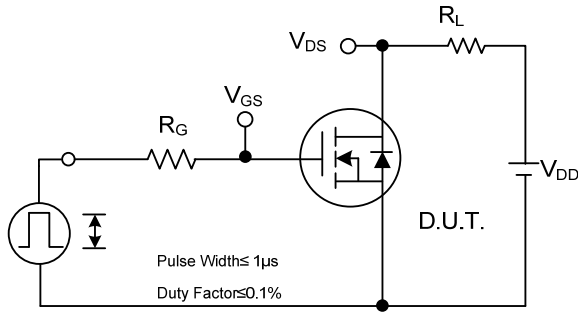


**Peak Diode Recovery  $dv/dt$  Test Circuit**

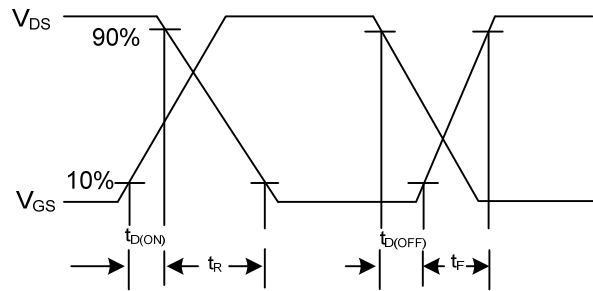


**Peak Diode Recovery  $dv/dt$  Waveforms**

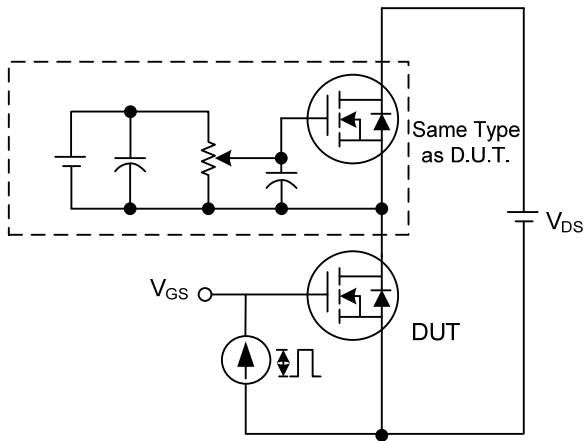
## TEST CIRCUITS AND WAVEFORMS



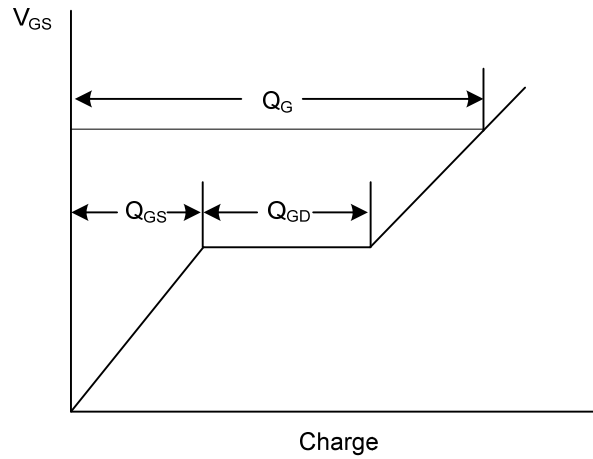
**Switching Test Circuit**



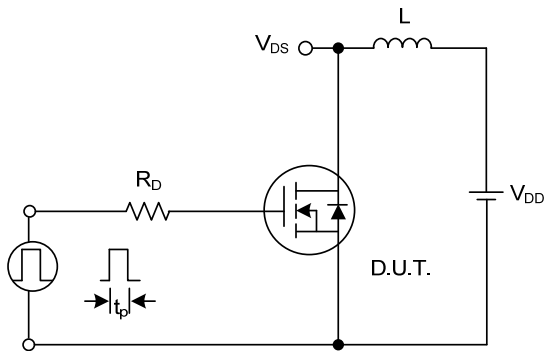
**Switching Waveforms**



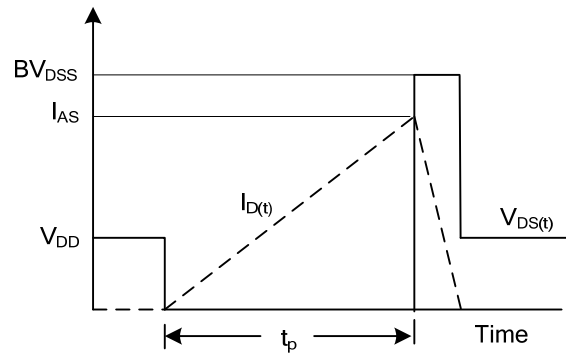
**Gate Charge Test Circuit**



**Gate Charge Waveform**

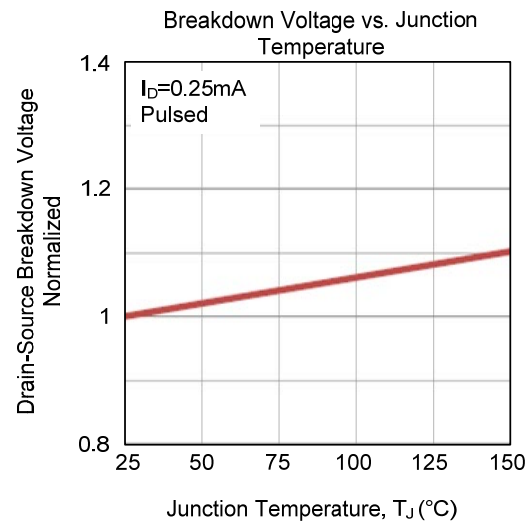
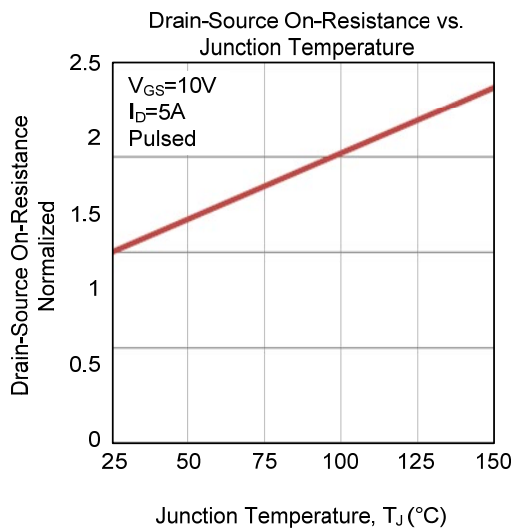
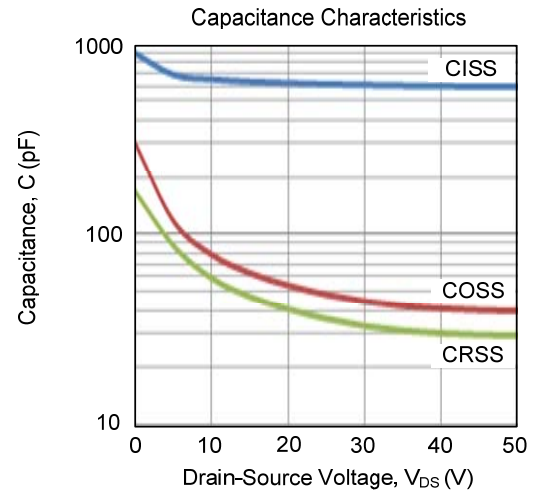
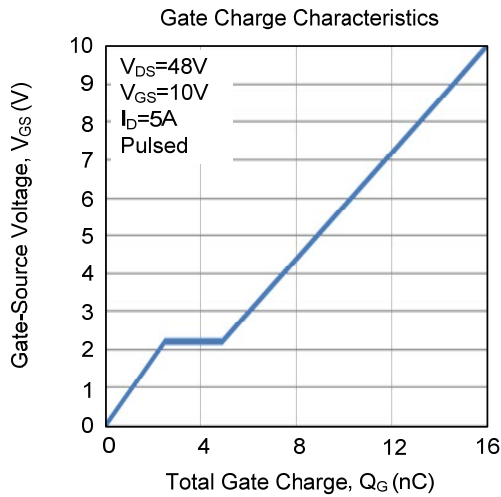
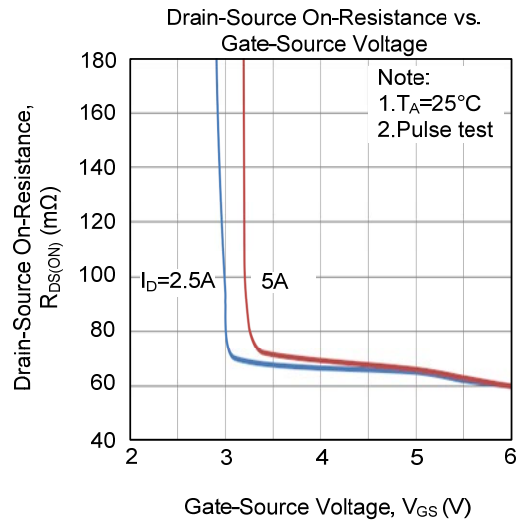
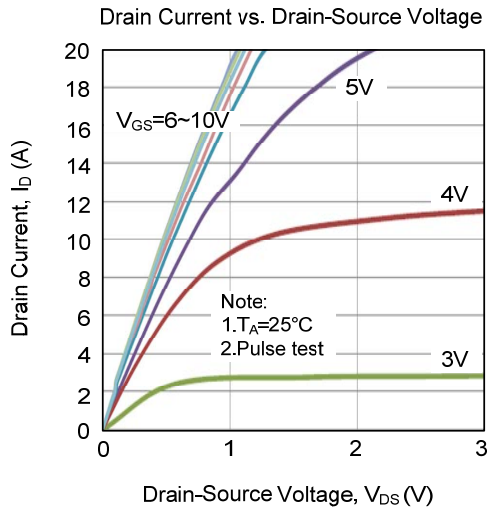


**Unclamped Inductive Switching Test Circuit**

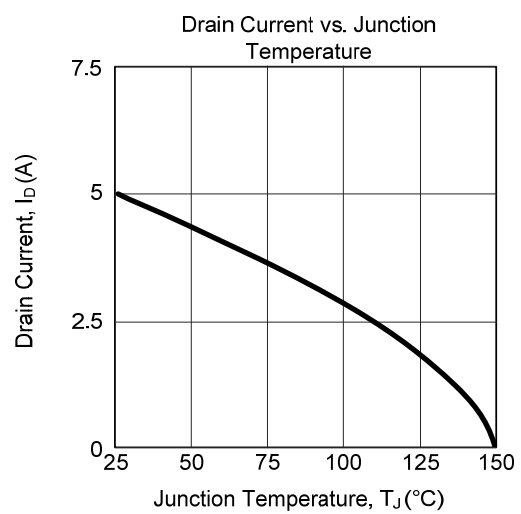
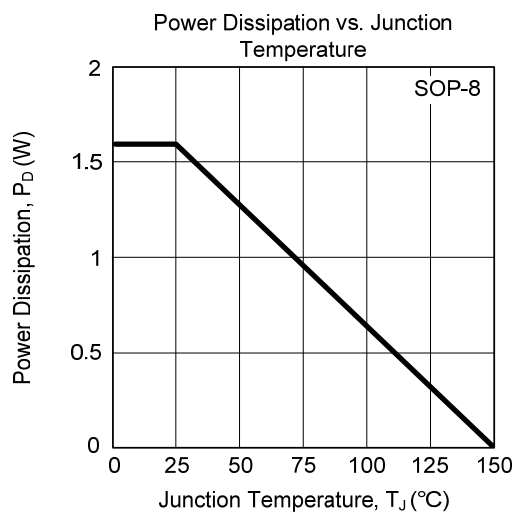
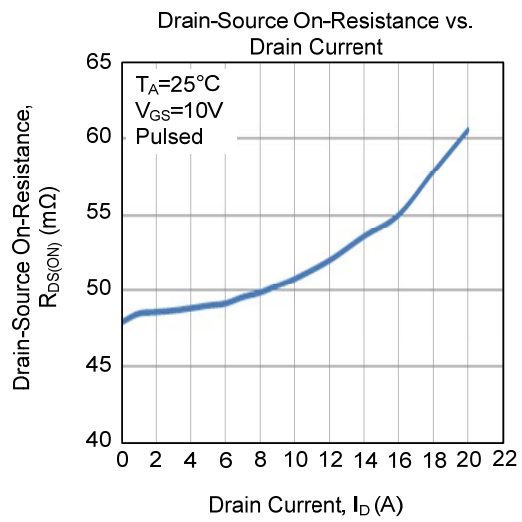
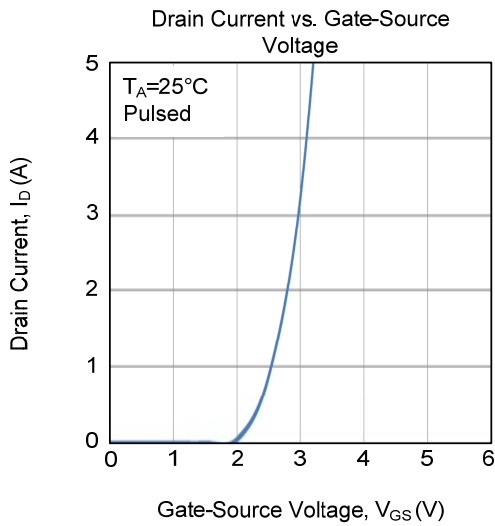
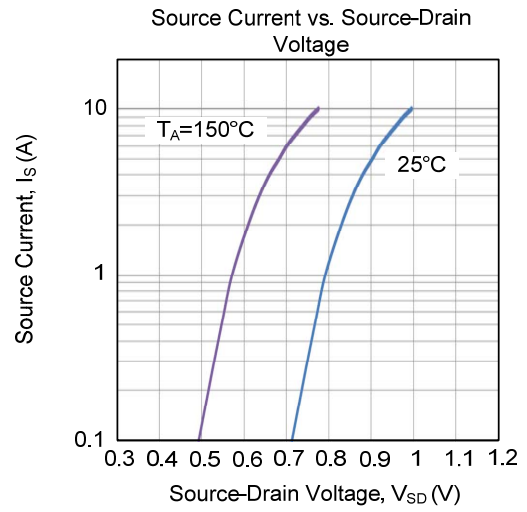
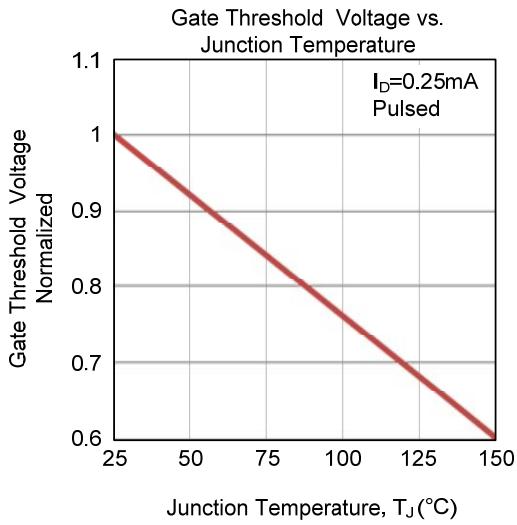


**Unclamped Inductive Switching Waveforms**

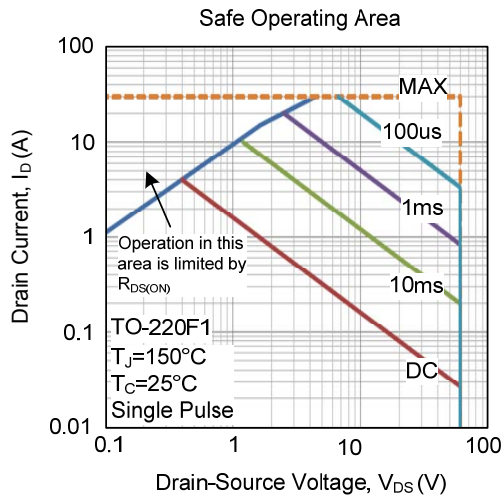
## TYPICAL CHARACTERISTICS



## TYPICAL CHARACTERISTICS (Cont.)



### ■ TYPICAL CHARACTERISTICS (Cont.)



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