



## 10NM95SZ

Power MOSFET

### 10A, 950V N-CHANNEL SUPER-JUNCTION MOSFET

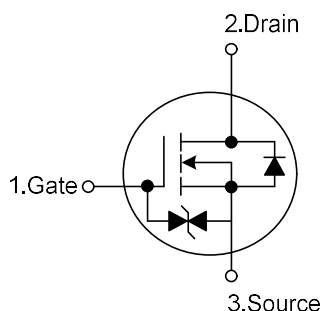
#### DESCRIPTION

The UTC **10NM95SZ** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

#### FEATURES

- \*  $R_{DS(ON)} \leq 0.75 \Omega$  @  $V_{GS} = 10V$ ,  $I_D = 2.5A$
- \* High Switching Speed
- \* With ESD Protected
- \* Green Product

#### SYMBOL

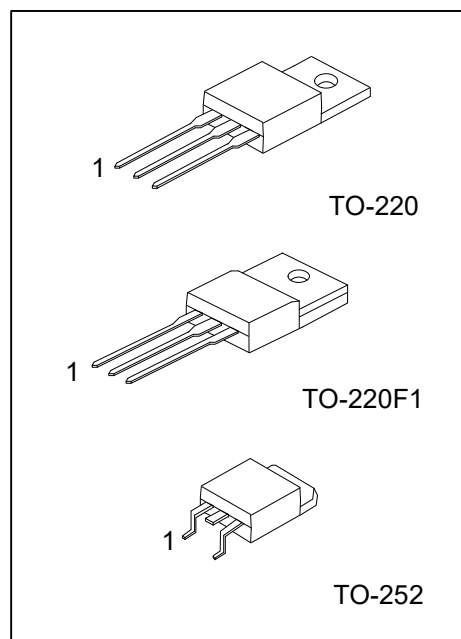


#### ORDERING INFORMATION

| Ordering Number |                 | Package  | Pin Assignment |   |   | Packing   |
|-----------------|-----------------|----------|----------------|---|---|-----------|
| Lead Free       | Halogen Free    |          | 1              | 2 | 3 |           |
| 10NM95SZL-TA3-T | 10NM95SZG-TA3-T | TO-220   | G              | D | S | Tube      |
| 10NM95SZL-TF1-T | 10NM95SZG-TF1-T | TO-220F1 | G              | D | S | Tube      |
| -               | 10NM95SZG-TN3-R | TO-252   | G              | D | S | Tape Reel |

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

|                 |                  |                                                 |
|-----------------|------------------|-------------------------------------------------|
| 10NM95SZG-TA3-T | (1)Packing Type  | (1) T: Tube, R: Tape Reel                       |
|                 | (2)Package Type  | (2) TA3: TO-220, TF1: TO-220F1, TN3: TO-252     |
|                 | (3)Green Package | (3) G: Halogen Free and Lead Free, L: Lead Free |



## ■ MARKING

| TO-220 / TO-220F1                                                                                                | TO-252                                                                   |
|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| <p>UTC<br/>10NM95SZ</p> <p>Lot Code ←</p> <p>→ L: Lead Free<br/>→ G: Halogen Free<br/>→ Date Code</p> <p>1 ←</p> | <p>UTC<br/>10NM95SZG</p> <p>Lot Code ←</p> <p>→ Date Code</p> <p>1 ←</p> |

### ■ ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub>=25°C, unless otherwise specified)

| PARAMETER                          |                        | SYMBOL           | RATINGS    | UNIT |
|------------------------------------|------------------------|------------------|------------|------|
| Drain-Source Voltage               |                        | V <sub>DSS</sub> | 950        | V    |
| Gate-Source Voltage                |                        | V <sub>GSS</sub> | ±20        | V    |
| Drain Current                      | Continuous             | I <sub>D</sub>   | 10         | A    |
|                                    | Pulsed (Note 2)        | I <sub>DM</sub>  | 30         | A    |
| Avalanche Energy                   | Single Pulsed (Note 3) | E <sub>AS</sub>  | 12.5       | mJ   |
| MOSFET dv/dt Ruggedness            |                        | dv/dt            | 100        | V/ns |
| Peak Diode Recovery dv/dt (Note 4) |                        |                  | 1.34       | V/ns |
| Power Dissipation                  | TO-220                 | P <sub>D</sub>   |            | W    |
|                                    | TO-220F1               |                  | 28         | W    |
|                                    | TO-252                 |                  | 40         | W    |
| Junction Temperature               |                        | T <sub>J</sub>   | +150       | °C   |
| Storage Temperature                |                        | T <sub>STG</sub> | -55 ~ +150 | °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 = 100mH, I<sub>AS</sub> = 0.5A, V<sub>DD</sub> = 90V, R<sub>G</sub> = 25 Ω Starting T<sub>J</sub> = 25°C

4. I<sub>SD</sub> ≤ 10A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C

### ■ THERMAL DATA

| PARAMETER           |          | SYMBOL          | RATINGS     | UNIT |
|---------------------|----------|-----------------|-------------|------|
| Junction to Ambient | TO-220   | θ <sub>JA</sub> | 62.5        | °C/W |
|                     | TO-220F1 |                 |             |      |
|                     | TO-252   |                 | 110         | °C/W |
| Junction to Case    | TO-220   | θ <sub>JC</sub> |             | °C/W |
|                     | TO-220F1 |                 | 4.46        | °C/W |
|                     | TO-252   |                 | 3.12 (Note) | °C/W |

Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

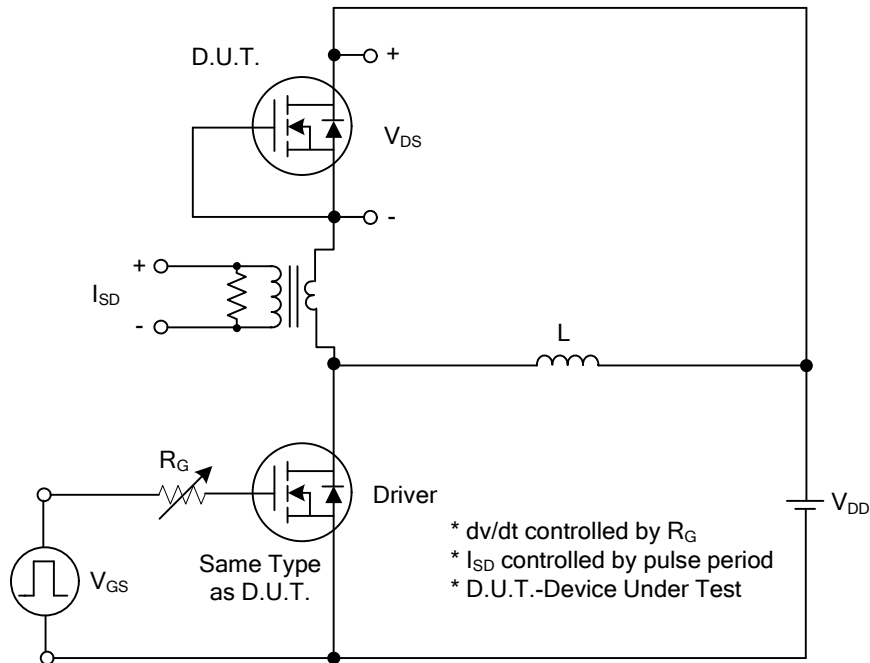
### ■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

| PARAMETER                                       |         | SYMBOL              | TEST CONDITIONS                                                                                      | MIN | TYP  | MAX  | UNIT |
|-------------------------------------------------|---------|---------------------|------------------------------------------------------------------------------------------------------|-----|------|------|------|
| OFF CHARACTERISTICS                             |         |                     |                                                                                                      |     |      |      |      |
| Drain-Source Breakdown Voltage                  |         | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> = 250μA                                                          | 950 |      |      | V    |
| Drain-Source Leakage Current                    |         | I <sub>DSS</sub>    | V <sub>DS</sub> =950V, V <sub>GS</sub> =0V                                                           |     |      | 10   | μA   |
| Gate-Source Leakage Current                     | Forward | I <sub>GSS</sub>    | V <sub>GS</sub> =20V, V <sub>DS</sub> =0V                                                            |     |      | 10   | μA   |
|                                                 | Reverse |                     | V <sub>GS</sub> =-20V, V <sub>DS</sub> =0V                                                           |     |      | -10  | μA   |
| ON CHARACTERISTICS                              |         |                     |                                                                                                      |     |      |      |      |
| Gate Threshold Voltage                          |         | V <sub>GS(TH)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                             | 2.5 |      | 4.5  | V    |
| Static Drain-Source On-State Resistance         |         | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =2.5A                                                           |     | 0.69 | 0.75 | Ω    |
| DYNAMIC CHARACTERISTICS                         |         |                     |                                                                                                      |     |      |      |      |
| Input Capacitance                               |         | C <sub>ISS</sub>    | V <sub>GS</sub> =0V, V <sub>DS</sub> =50V, f=1.0 MHz                                                 |     | 566  |      | pF   |
| Output Capacitance                              |         | C <sub>OSS</sub>    |                                                                                                      |     | 69   |      | pF   |
| Reverse Transfer Capacitance                    |         | C <sub>RSS</sub>    |                                                                                                      |     | 5.7  |      | pF   |
| SWITCHING CHARACTERISTICS                       |         |                     |                                                                                                      |     |      |      |      |
| Total Gate Charge                               |         | Q <sub>G</sub>      | V <sub>DS</sub> =760V, V <sub>GS</sub> =10V, I <sub>D</sub> =10A                                     |     | 43   |      | nC   |
| Gate to Source Charge                           |         | Q <sub>GS</sub>     |                                                                                                      |     | 11   |      | nC   |
| Gate to Drain Charge                            |         | Q <sub>GD</sub>     |                                                                                                      |     | 10   |      | nC   |
| Turn-on Delay Time (Note 1)                     |         | t <sub>D(ON)</sub>  | V <sub>DS</sub> =100V, V <sub>GS</sub> =10V, I <sub>D</sub> =10A,<br>R <sub>G</sub> =25Ω (Note 1, 2) |     | 10   |      | ns   |
| Rise Time                                       |         | t <sub>R</sub>      |                                                                                                      |     | 21   |      | ns   |
| Turn-off Delay Time                             |         | t <sub>D(OFF)</sub> |                                                                                                      |     | 46   |      | ns   |
| Fall-Time                                       |         | t <sub>F</sub>      |                                                                                                      |     | 31   |      | ns   |
| SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS |         |                     |                                                                                                      |     |      |      |      |
| Maximum Body-Diode Continuous Current           |         | I <sub>S</sub>      |                                                                                                      |     |      | 10   | A    |
| Maximum Body-Diode Pulsed Current               |         | I <sub>SM</sub>     |                                                                                                      |     |      | 30   | A    |
| Drain-Source Diode Forward Voltage (Note 1)     |         | V <sub>SD</sub>     | I <sub>S</sub> =10A, V <sub>GS</sub> =0V                                                             |     |      | 1.4  | V    |
| Reverse Recovery Time (Note 1)                  |         | t <sub>rr</sub>     | I <sub>S</sub> =10A, V <sub>GS</sub> =0V                                                             |     | 378  |      | ns   |
| Reverse Recovery Charge                         |         | Q <sub>rr</sub>     | dI <sub>F</sub> /dt=100A/μs (Note1)                                                                  |     | 5.2  |      | μC   |

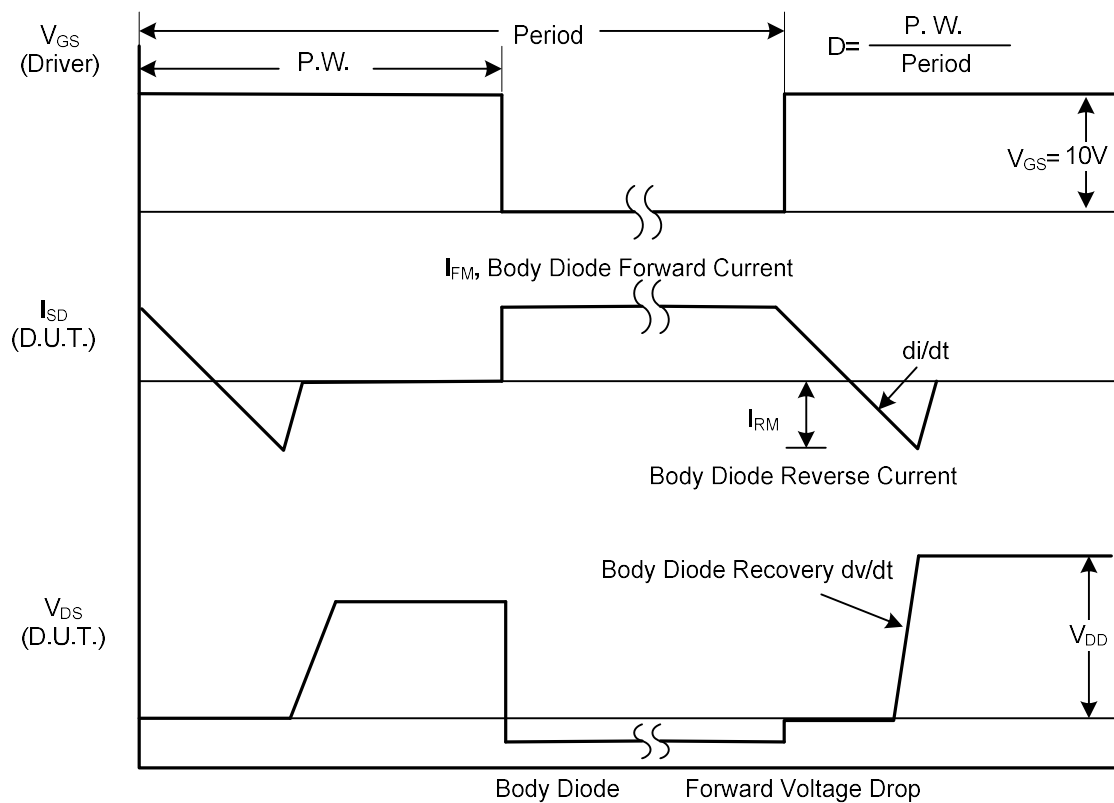
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

## ■ TEST CIRCUITS AND WAVEFORMS

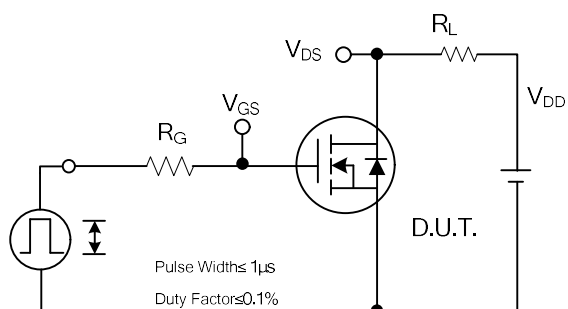


Peak Diode Recovery dv/dt Test Circuit

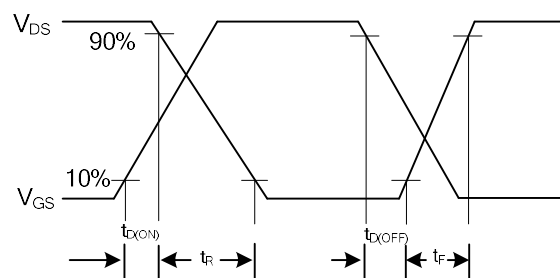


Peak Diode Recovery dv/dt Waveforms

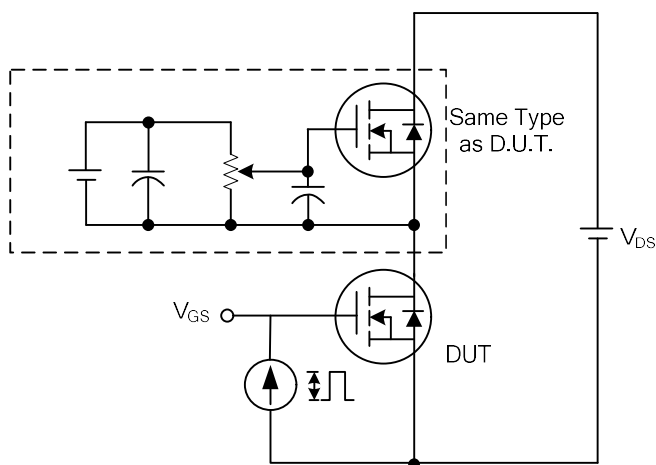
### ■ TEST CIRCUITS AND WAVEFORMS



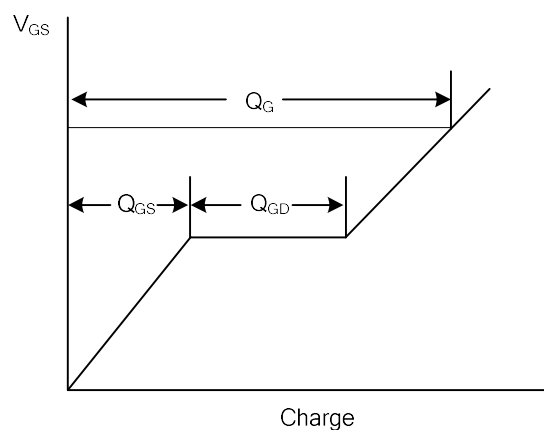
Switching Test Circuit



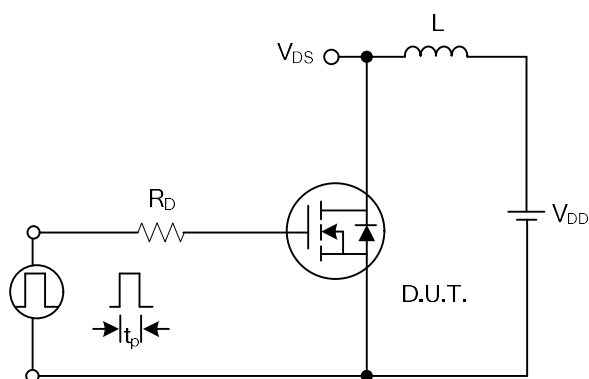
Switching Waveforms



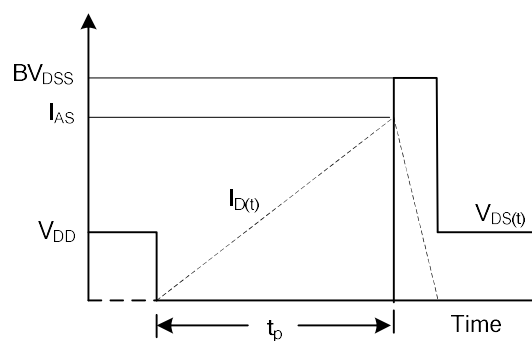
Gate Charge Test Circuit



Gate Charge Waveform

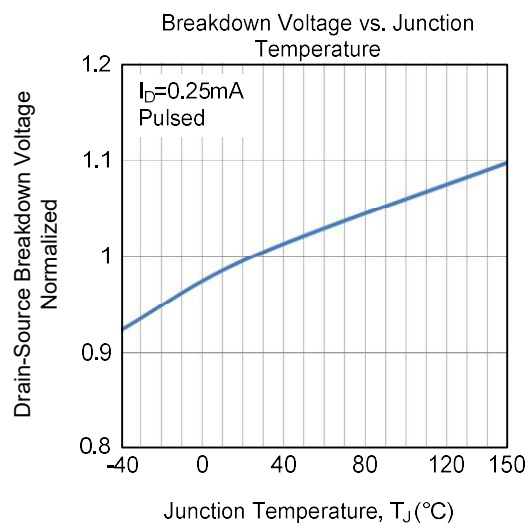
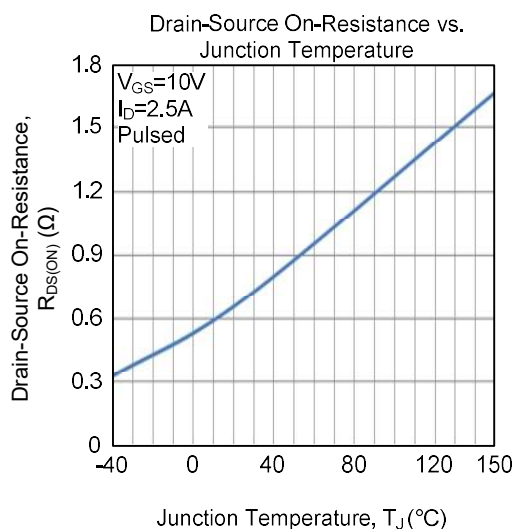
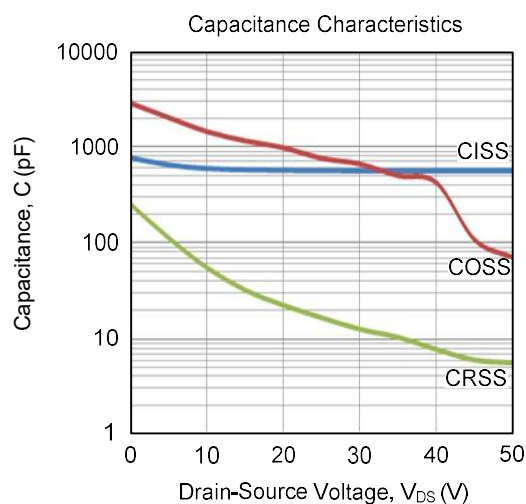
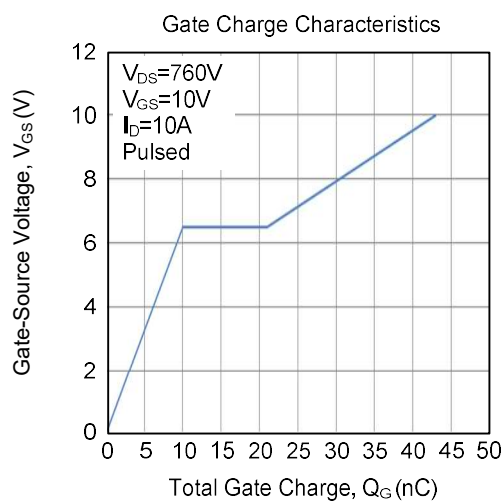
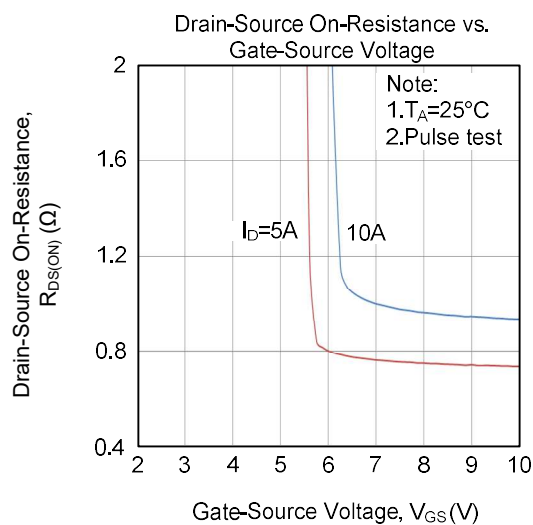
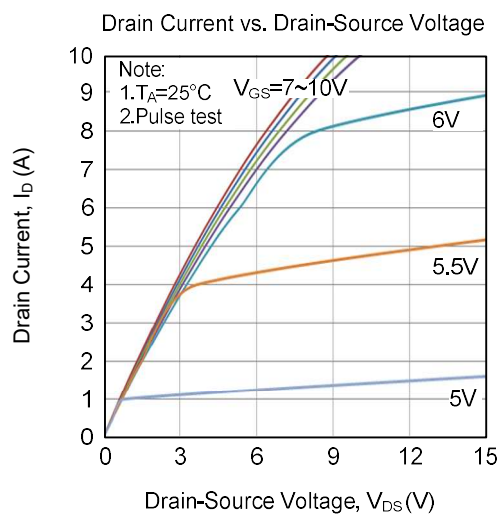


Unclamped Inductive Switching Test Circuit

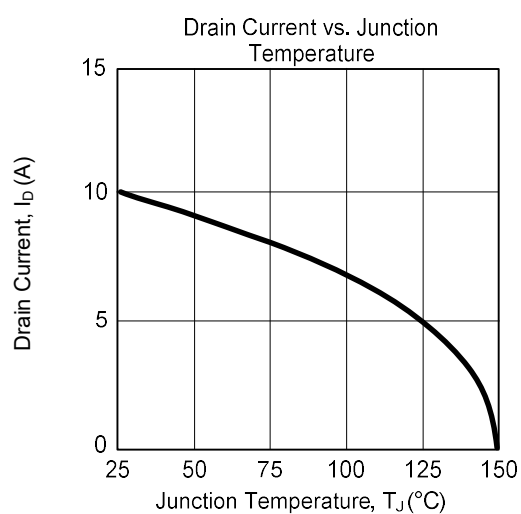
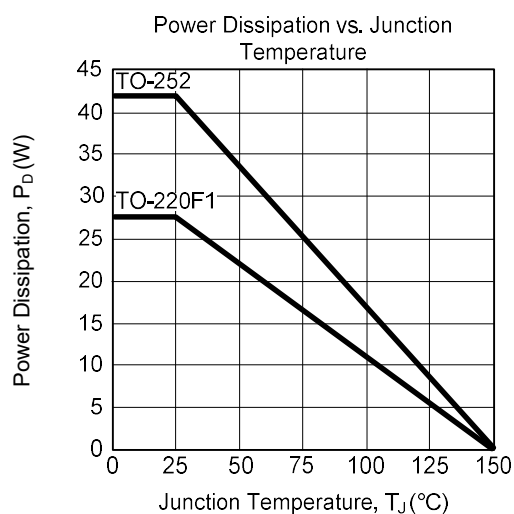
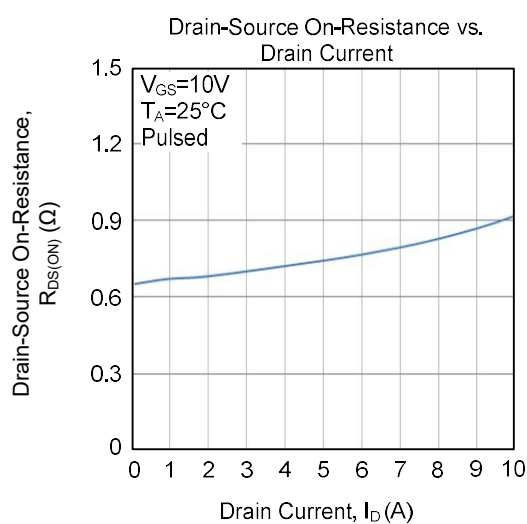
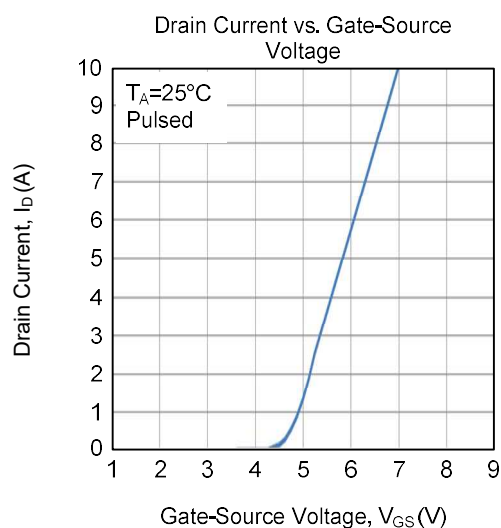
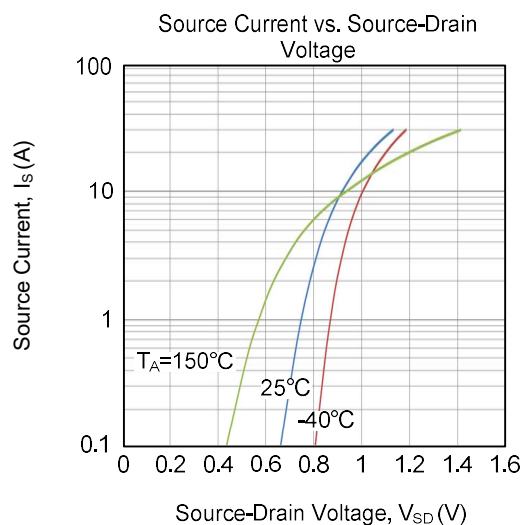
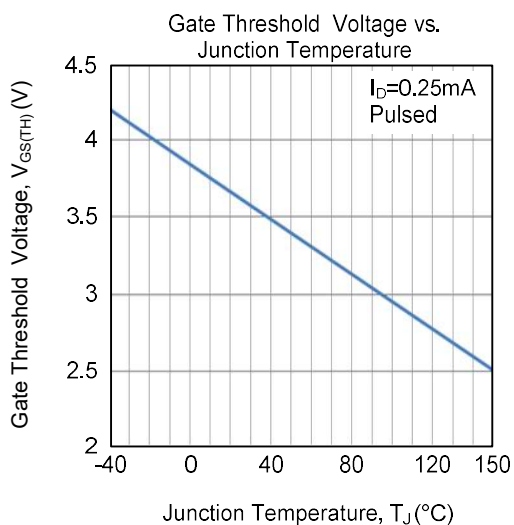


Unclamped Inductive Switching Waveforms

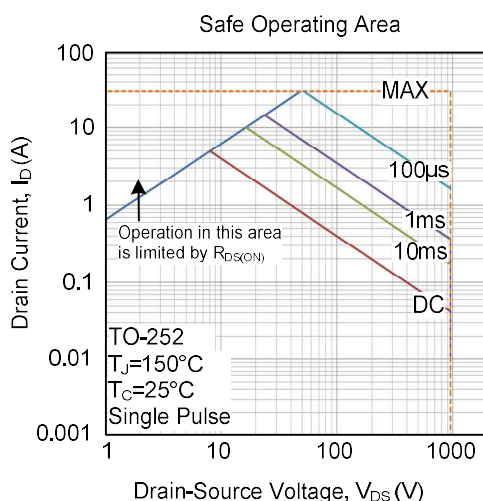
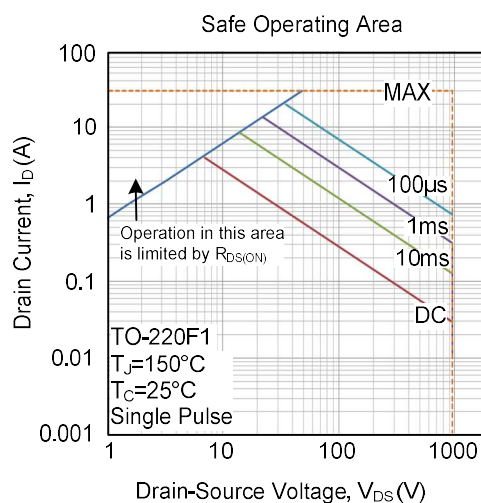
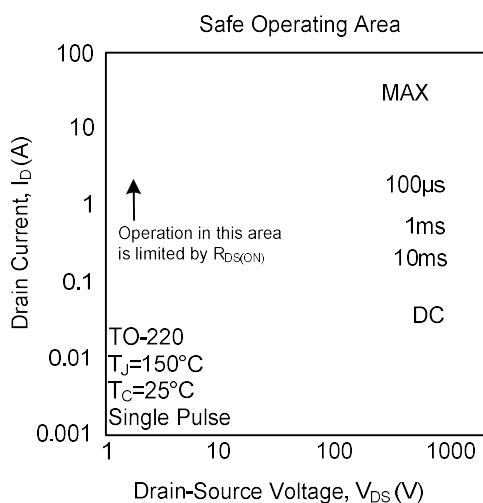
### ■ TYPICAL CHARACTERISTICS



### ■ TYPICAL CHARACTERISTICS (Cont.)



### ■ TYPICAL CHARACTERISTICS (Cont.)



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