



## 18NM65

Power MOSFET

### 18A, 650V N-CHANNEL SUPER-JUNCTION MOSFET

#### ■ DESCRIPTION

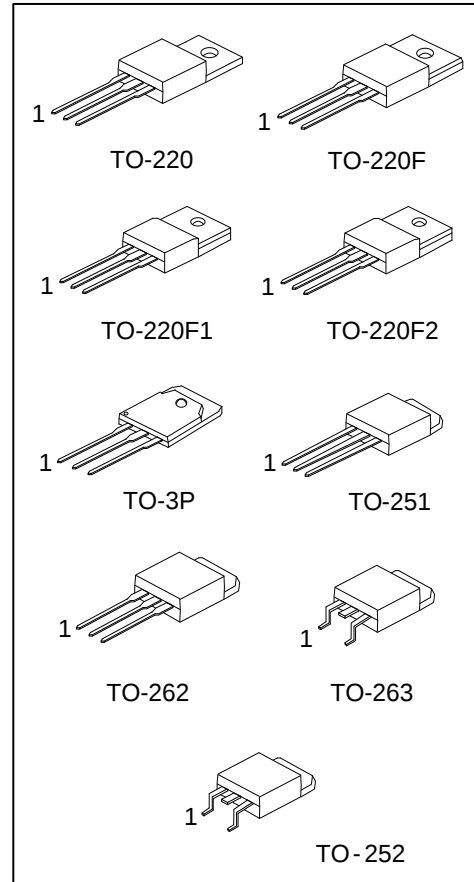
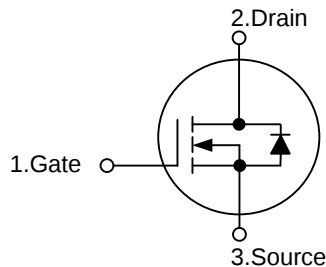
The UTC **18NM65** is a high voltage super junction MOSFET and is designed to have better characteristics.

The UTC **18NM65** Utilizing an advanced charge-balance technology, enhance system efficiency, improve EMI and reliability, such as low gate charge, low on-state resistance and have a high power density and high rugged avalanche characteristics. This super junction MOSFET usually used at AC/DC power conversion, and industrial power applications.

#### ■ FEATURES

- \*  $R_{DS(ON)} \leq 0.33\Omega$  @  $V_{GS}=10V$ ,  $I_D=9.0A$
- \* Fast Switching Capability
- \* Avalanche Energy Specified
- \* Improved  $dv/dt$  Capability, High Ruggedness

#### ■ SYMBOL



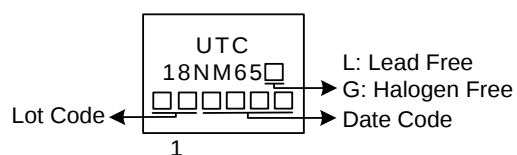
### ORDERING INFORMATION

| Ordering Number |               | Package  | Pin Assignment |   |   | Packing   |
|-----------------|---------------|----------|----------------|---|---|-----------|
| Lead Free       | Halogen Free  |          | 1              | 2 | 3 |           |
| 18NM65L-TA3-T   | 18NM65G-TA3-T | TO-220   | G              | D | S | Tube      |
| 18NM65L-TF1-T   | 18NM65G-TF1-T | TO-220F1 | G              | D | S | Tube      |
| 18NM65L-TF2-T   | 18NM65G-TF2-T | TO-220F2 | G              | D | S | Tube      |
| 18NM65L-TF3-T   | 18NM65G-TF3-T | TO-220F  | G              | D | S | Tube      |
| 18NM65L-TM3-T   | 18NM65G-TM3-T | TO-251   | G              | D | S | Tube      |
| 18NM65L-TN3-R   | 18NM65G-TN3-R | TO-252   | G              | D | S | Tape Reel |
| 18NM65L-T2Q-T   | 18NM65G-T2Q-T | TO-262   | G              | D | S | Tube      |
| 18NM65L-TQ2-T   | 18NM65G-TQ2-T | TO-263   | G              | D | S | Tube      |
| 18NM65L-TQ2-R   | 18NM65G-TQ2-R | TO-263   | G              | D | S | Tape Reel |
| 18NM65L-T3P-T   | 18NM65G-T3P-T | TO-3P    | G              | D | S | Tube      |

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

|                                                                                         |                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>18NM65G-TA3-T</p> <p>(1) Packing Type<br/>(2) Package Type<br/>(3) Green Package</p> | <p>(1) T: Tube, R: Tape Reel<br/>(2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2<br/>TF3: TO-220F, TM3: TO-251, TN3: TO-252,<br/>T2Q: TO-262, TQ2: TO-263, T3P: TO-3P<br/>(3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### MARKING



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

| PARAMETER                          |                              | SYMBOL    | RATINGS    | UNIT             |
|------------------------------------|------------------------------|-----------|------------|------------------|
| Drain-Source Voltage               |                              | $V_{DSS}$ | 650        | V                |
| Gate-Source Voltage                |                              | $V_{GSS}$ | $\pm 30$   | V                |
| Drain Current                      | Continuous                   | $I_D$     | 18         | A                |
|                                    | Pulsed (Note 2)              | $I_{DM}$  | 36         | A                |
| Avalanche Current (Note 2)         |                              | $I_{AR}$  | 2.9        | A                |
| Avalanche Energy                   | Single Pulsed (Note 3)       | $E_{AS}$  | 151        | mJ               |
|                                    | Repetitive                   | $E_{AR}$  | 0.44       | mJ               |
| Peak Diode Recovery dv/dt (Note 4) |                              | dv/dt     | 6.0        | V/ns             |
| Power Dissipation                  | TO-220/TO-262<br>TO-263      | $P_D$     | 104        | W                |
|                                    | TO-220F/TO-220F1<br>TO-220F2 |           | 33         | W                |
|                                    | TO-251/TO-252                |           | 83         | W                |
|                                    | TO-3P                        |           | 200        | 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.  $L = 10\text{mH}$ ,  $I_{AS} = 5.5\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 18\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

# **■ THERMAL DATA**

| PARAMETER           |                                                      | SYMBOL        | RATINGS    | UNIT               |
|---------------------|------------------------------------------------------|---------------|------------|--------------------|
| Junction to Ambient | TO-220/TO-220F<br>TO-220F1/TO-220F2<br>TO-262/TO-263 | $\theta_{JA}$ | 62.5       | $^\circ\text{C/W}$ |
|                     | TO-251/TO-252                                        |               | 110        | $^\circ\text{C/W}$ |
|                     | TO-3P                                                |               | 40         | $^\circ\text{C/W}$ |
|                     |                                                      |               |            |                    |
|                     |                                                      |               |            |                    |
| Junction to Case    | TO-220/TO-262<br>TO-263                              | $\theta_{JC}$ | 1.2        | $^\circ\text{C/W}$ |
|                     | TO-220F/TO-220F1<br>TO-220F2                         |               | 3.78       | $^\circ\text{C/W}$ |
|                     | TO-251/TO-252                                        |               | 1.5 (Note) | $^\circ\text{C/W}$ |
|                     | TO-3P                                                |               | 0.625      | $^\circ\text{C/W}$ |
|                     |                                                      |               |            |                    |

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

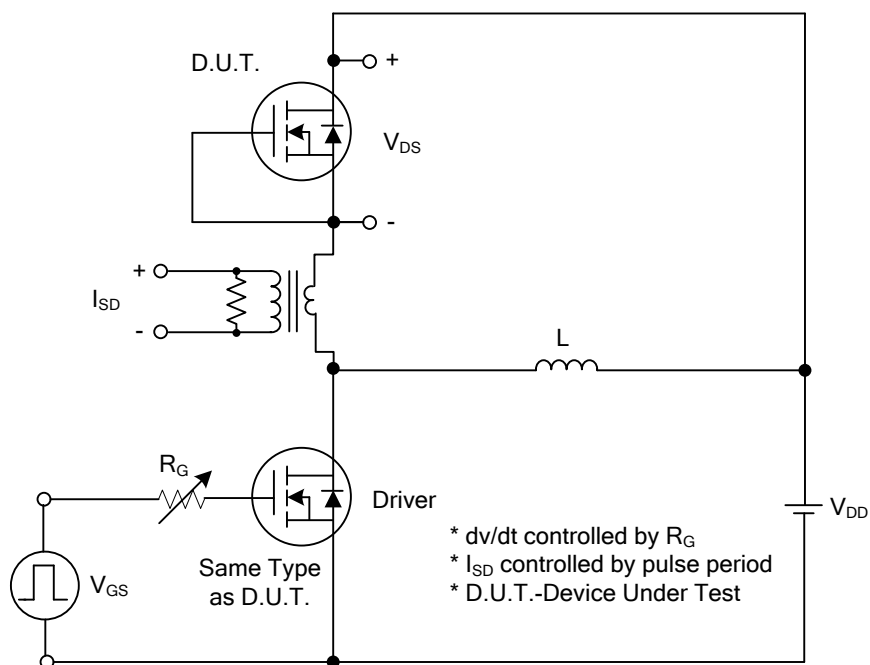
■ **ELECTRICAL CHARACTERISTICS** ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

| 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                                              | 650 |      |      | V    |
| Drain-Source Leakage Current                          | I <sub>DSS</sub>    | V <sub>DS</sub> =650V, V <sub>GS</sub> =0V                                              |     |      | 10   | μA   |
| Gate-Body Leakage Current                             | I <sub>GSS</sub>    | V <sub>DS</sub> =0V, V <sub>GS</sub> =±30V                                              |     |      | ±100 | nA   |
| 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-Resistance                     | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =9.0A                                              |     | 0.28 | 0.33 | Ω    |
| DYNAMIC PARAMETERS                                    |                     |                                                                                         |     |      |      |      |
| Input Capacitance                                     | C <sub>ISS</sub>    | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1.0MHz                                     |     | 1140 |      | pF   |
| Output Capacitance                                    | C <sub>OSS</sub>    |                                                                                         |     | 810  |      | pF   |
| Reverse Transfer Capacitance                          | C <sub>RSS</sub>    |                                                                                         |     | 62   |      | pF   |
| Gate Resistance                                       | R <sub>G</sub>      | f =1MHz, Open Drain                                                                     |     |      | 5    | Ω    |
| SWITCHING PARAMETERS                                  |                     |                                                                                         |     |      |      |      |
| Total Gate Charge (Note 1)                            | Q <sub>G</sub>      | V <sub>DS</sub> =520V, V <sub>GS</sub> =10V<br>I <sub>D</sub> =18A, I <sub>G</sub> =1mA |     | 44   |      | nC   |
| Gate Source Charge                                    | Q <sub>GS</sub>     |                                                                                         |     | 13   |      | nC   |
| Gate Drain Charge                                     | Q <sub>GD</sub>     |                                                                                         |     | 17   |      | nC   |
| Turn-ON Delay Time (Note 1)                           | t <sub>D(ON)</sub>  | V <sub>DS</sub> =100V, V <sub>GS</sub> =10V<br>I <sub>D</sub> =18A, R <sub>G</sub> =25Ω |     | 18   |      | ns   |
| Turn-ON Rise Time                                     | t <sub>R</sub>      |                                                                                         |     | 25   |      | ns   |
| Turn-OFF Delay Time                                   | t <sub>D(OFF)</sub> |                                                                                         |     | 50   |      | ns   |
| Turn-OFF Fall-Time                                    | t <sub>F</sub>      |                                                                                         |     | 76   |      | ns   |
| SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS       |                     |                                                                                         |     |      |      |      |
| Maximum Continuous Drain-Source Diode Forward Current | I <sub>S</sub>      |                                                                                         |     |      | 18   | A    |
| Maximum Pulsed Drain-Source Diode Forward Current     | I <sub>SM</sub>     |                                                                                         |     |      | 36   | A    |
| Drain-Source Diode Forward Voltage (Note 1)           | V <sub>SD</sub>     | I <sub>F</sub> =I <sub>S</sub> ,V <sub>GS</sub> =0V                                     |     |      | 1.5  | V    |
| Reverse Recovery Time (Note 1)                        | t <sub>rr</sub>     | I <sub>S</sub> =18A, V <sub>GS</sub> =0V,                                               |     | 420  |      | ns   |
| Reverse Recovery Charge                               | Q <sub>rr</sub>     | di <sub>F</sub> /dt=100A/μs                                                             |     | 7.0  |      | μC   |

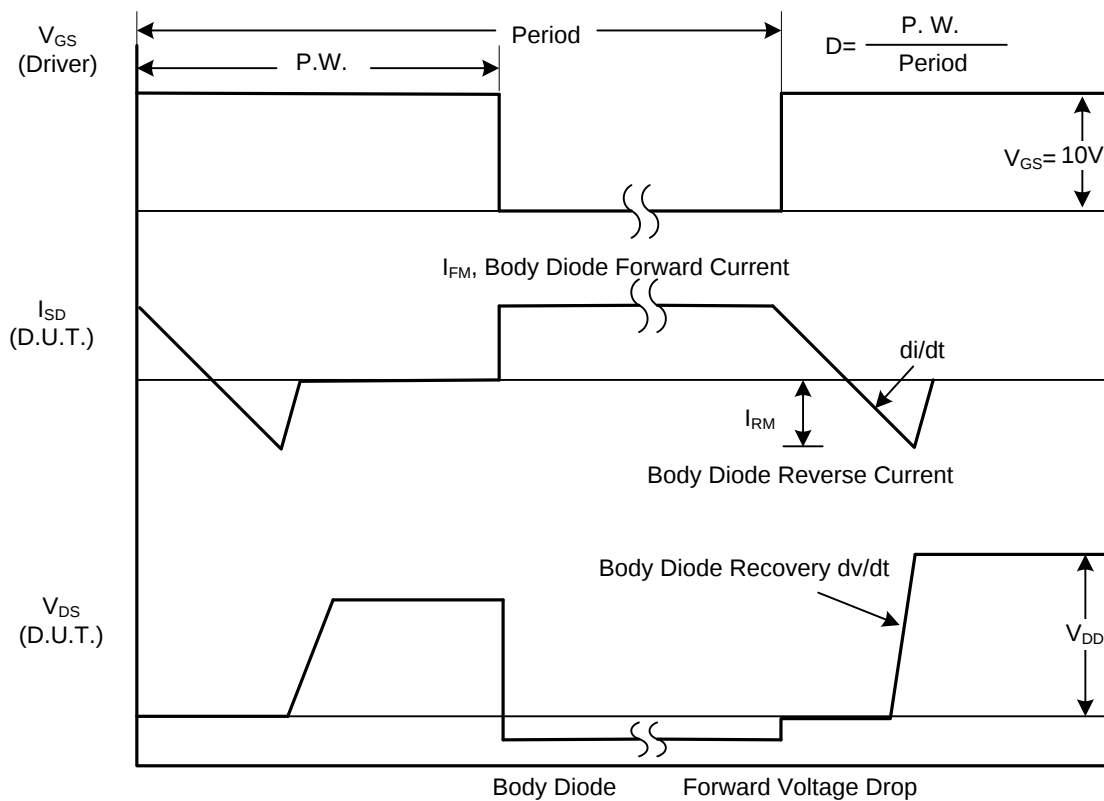
Notes: 1. Pulse Test : Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating ambient temperature.

## ■ TEST CIRCUITS AND WAVEFORMS

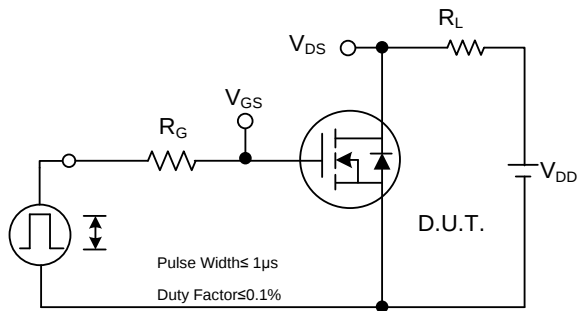


Peak Diode Recovery  $dv/dt$  Test Circuit

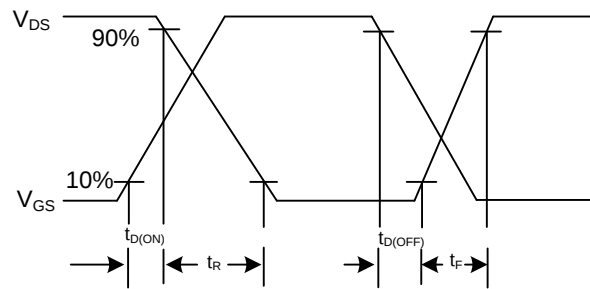


Peak Diode Recovery  $dv/dt$  Waveforms

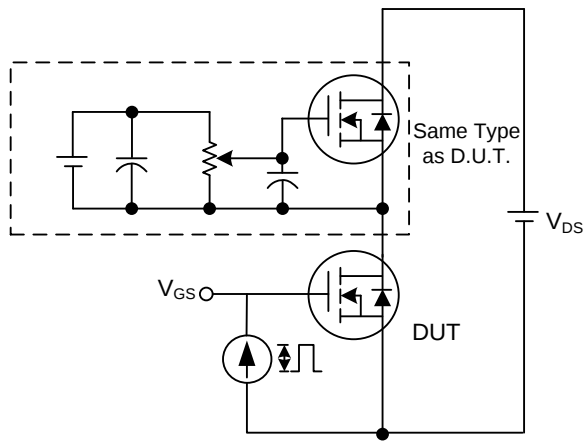
## ■ TEST CIRCUITS AND WAVEFORMS



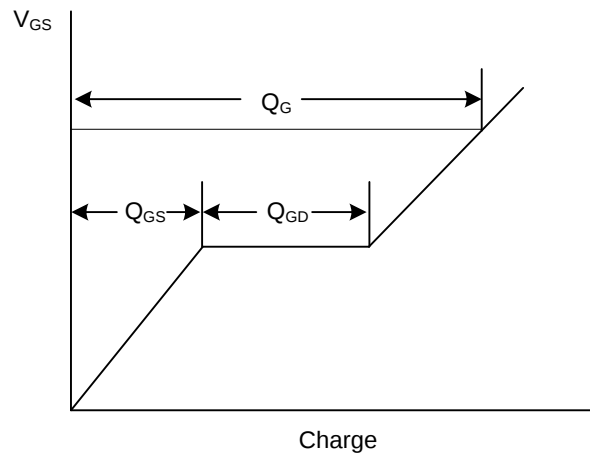
Switching Test Circuit



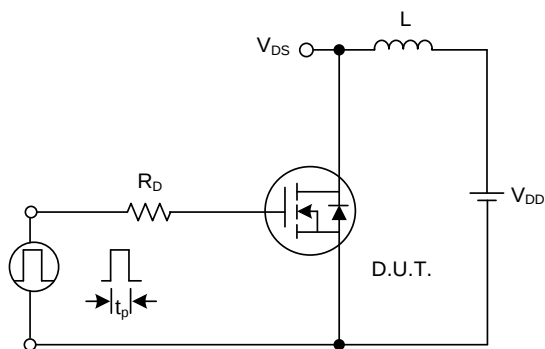
Switching Waveforms



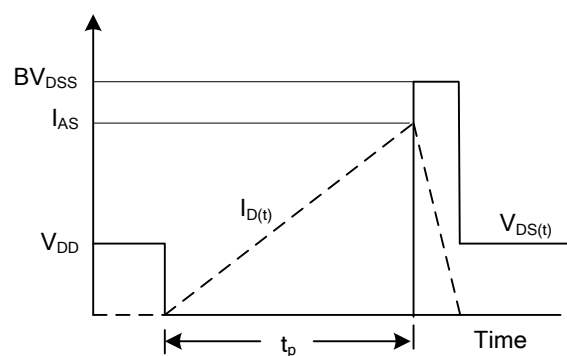
Gate Charge Test Circuit



Gate Charge Waveform

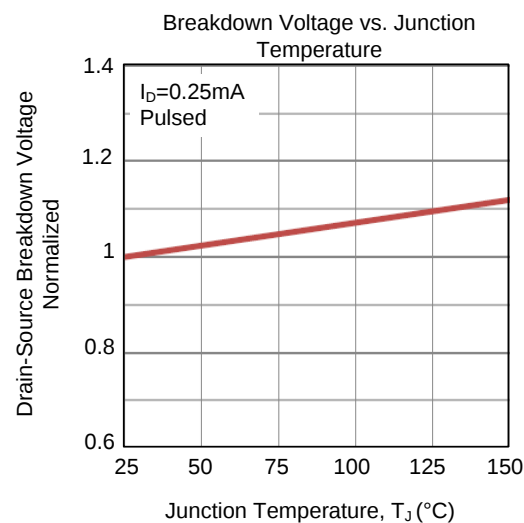
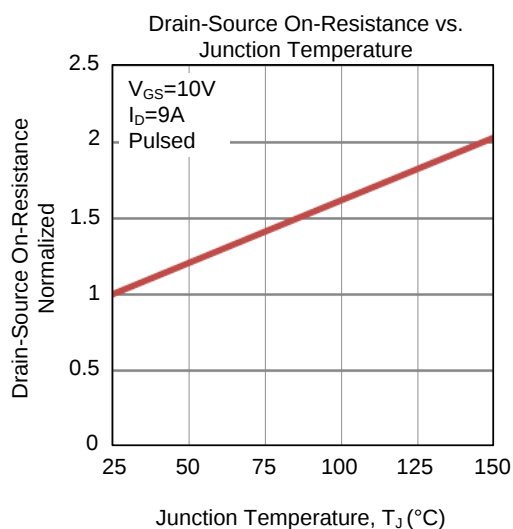
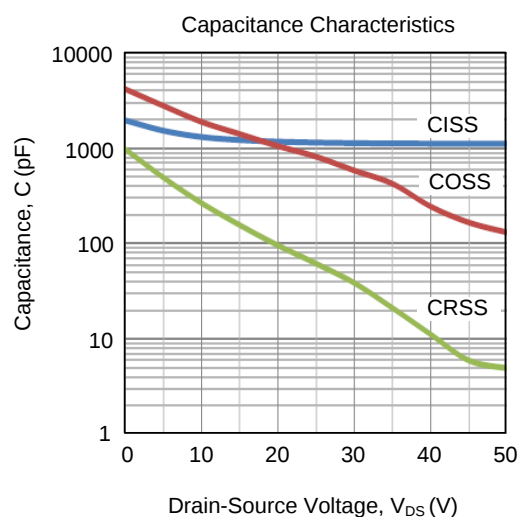
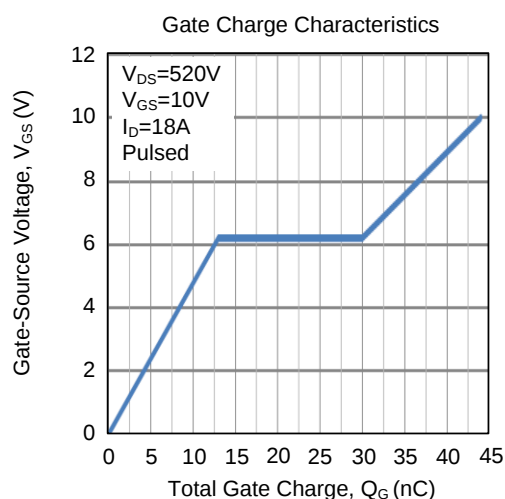
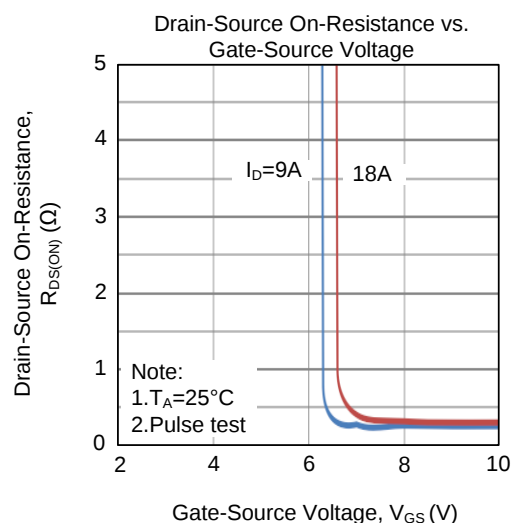
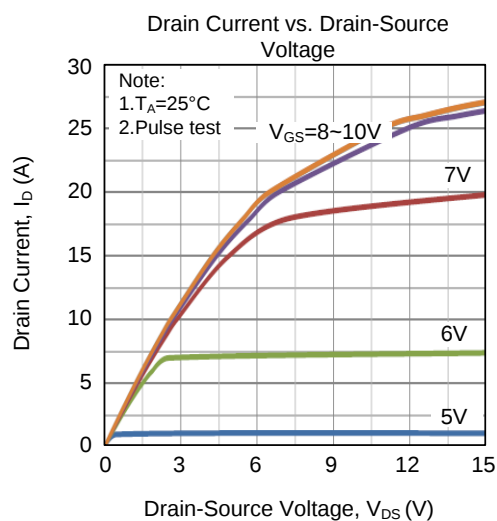


Unclamped Inductive Switching Test Circuit

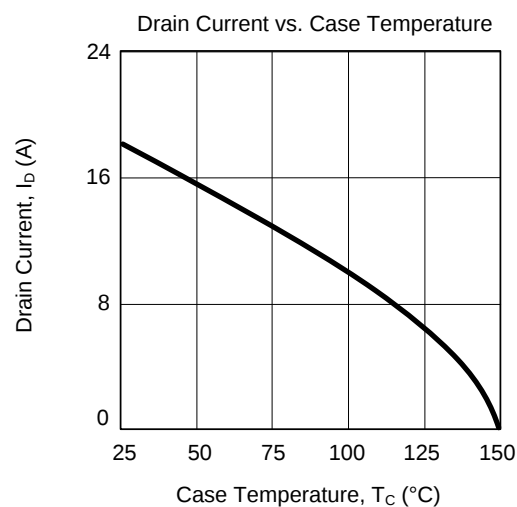
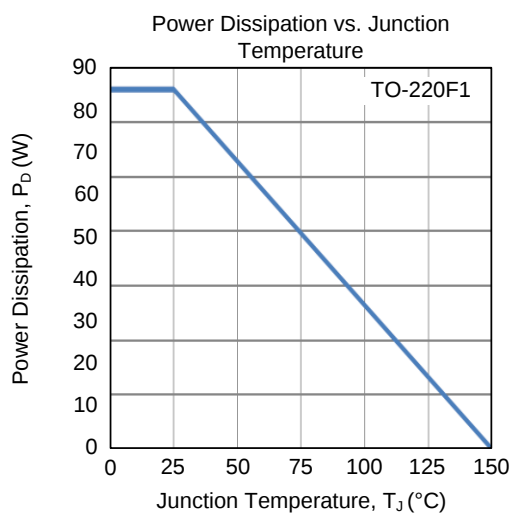
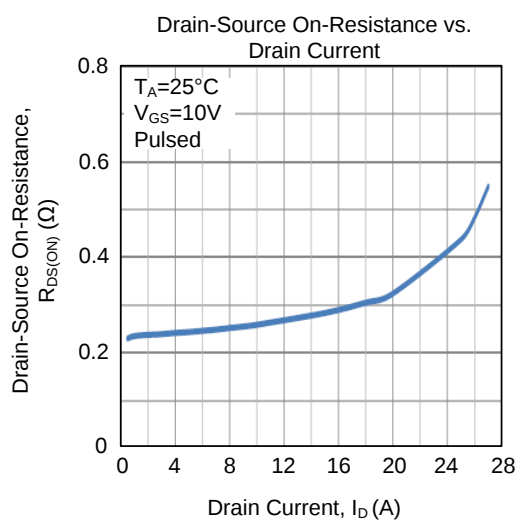
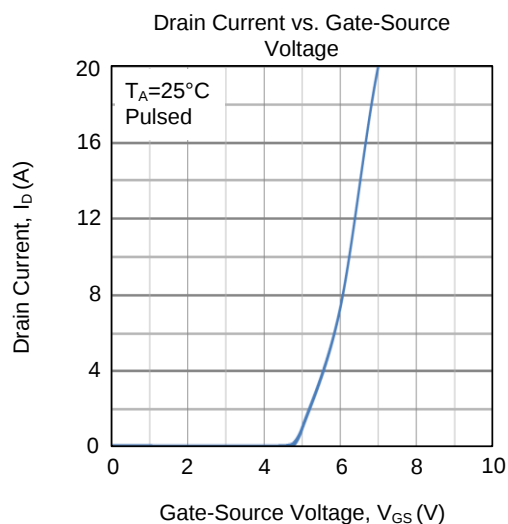
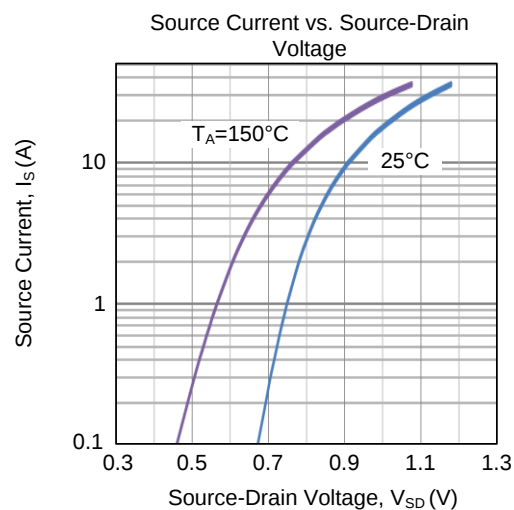
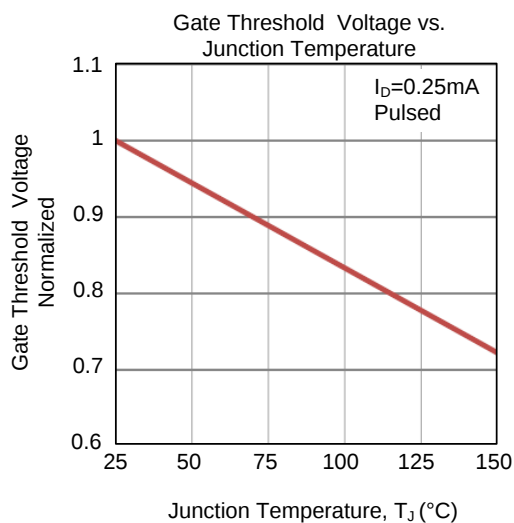


Unclamped Inductive Switching Waveforms

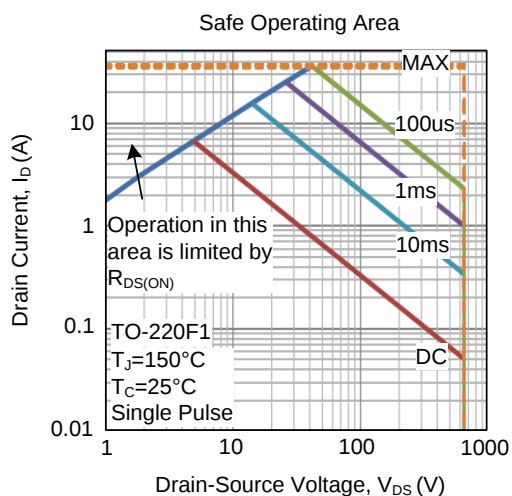
## TYPICAL CHARACTERISTICS



# **TYPICAL CHARACTERISTICS (Cont.)**



## ■ TYPICAL CHARACTERISTICS (Cont.)



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