



# USJ60R130Z

Power MOSFET

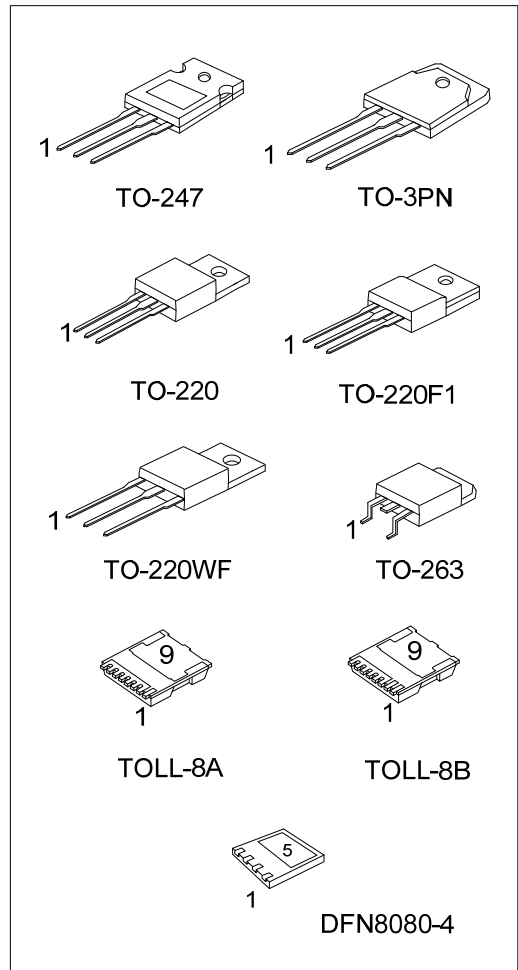
## 33A, 600V N-CHANNEL SUPER-JUNCTION MOSFET

### DESCRIPTION

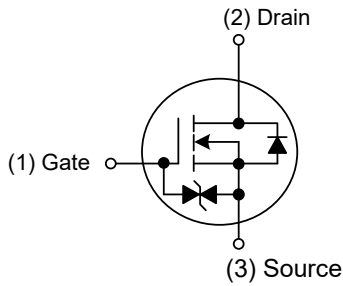
The **UTC USJ60R130Z** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

### FEATURES

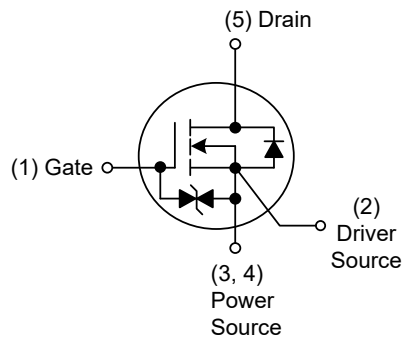
- \*  $R_{DS(ON)} \leq 130 \text{ m}\Omega$  @  $V_{GS}=10\text{V}$ ,  $I_D=8.25\text{A}$
- \* Fast switching capability
- \* Avalanche energy tested
- \* Improved dv/dt capability, high ruggedness
- \* With ESD Protected



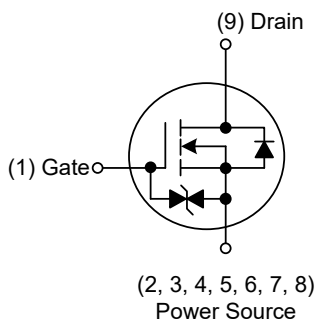
### SYMBOL



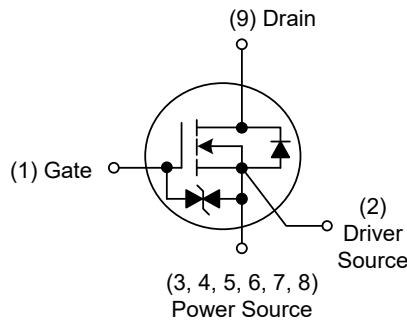
TO-220 / TO-220F1 / TO-220WF  
TO-247 / TO-263 / TO-3PN



DFN8080-4



TOLL-8A



TOLL-8B

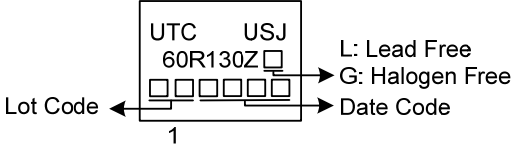
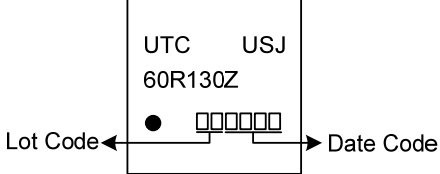
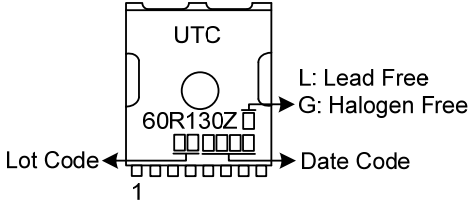
### ORDERING INFORMATION

| Ordering Number        |                        | Package   | Pin Assignment |   |   |   |   |   |   |   |   | Packing |           |
|------------------------|------------------------|-----------|----------------|---|---|---|---|---|---|---|---|---------|-----------|
| Lead Free              | Halogen Free           |           | 1              | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |         |           |
| USJ60R130ZL-TA3-T      | USJ60R130ZG-TA3-T      | TO-220    | G              | D | S | - | - | - | - | - | - | -       | Tube      |
| USJ60R130ZL-TF1-T      | USJ60R130ZG-TF1-T      | TO-220F1  | G              | D | S | - | - | - | - | - | - | -       | Tube      |
| USJ60R130ZL-TW1-T      | USJ60R130ZG-TW1-T      | TO-220WF  | G              | D | S | - | - | - | - | - | - | -       | Tube      |
| USJ60R130ZL-TQ2-T      | USJ60R130ZG-TQ2-T      | TO-263    | G              | D | S | - | - | - | - | - | - | -       | Tube      |
| USJ60R130ZL-TQ2-R      | USJ60R130ZG-TQ2-R      | TO-263    | G              | D | S | - | - | - | - | - | - | -       | Tape Reel |
| USJ60R130ZL-T3N-T      | USJ60R130ZG-T3N-T      | TO-3PN    | G              | D | S | - | - | - | - | - | - | -       | Tube      |
| USJ60R130ZL-T47-T      | USJ60R130ZG-T47-T      | TO-247    | G              | D | S | - | - | - | - | - | - | -       | Tube      |
| USJ60R130ZL-T8A-R      | USJ60R130ZG-T8A-R      | TOLL-8A   | G              | S | S | S | S | S | S | S | S | D       | Tape Reel |
| USJ60R130ZL-T8B-R      | USJ60R130ZG-T8B-R      | TOLL-8B   | G              | S | S | S | S | S | S | S | S | D       | Tape Reel |
| USJ60R130ZL-K04-8080-R | USJ60R130ZG-K04-8080-R | DFN8080-4 | G              | S | S | S | S | D | - | - | - | -       | Tape Reel |

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

|   |  |
|---|--|
| <p>USJ60R130ZG-TA3-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p> | <p>(1) T: Tube, R: Tape Reel</p> <p>(2) TA3: TO-220, TF1: TO-220F1, TW1: TO-220WF</p> <p>TQ2: TO-263, T3N: TO-3PN, T47: TO-247</p> <p>T8A: TOLL-8A, T8B: TOLL-8B</p> <p>K04-8080: DFN8080-4</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|---|--|

■ MARKING

|  |  |
|--|--|
| <p>TO-220 / TO-220F1 / TO-220WF<br/>TO-247 / TO-263 / TO-3PN</p>   | <p>DFN8080-4</p>   |
|  <p>Lot Code ← [ ] [ ] [ ] [ ] → Date Code</p> <p>1</p> <p>L: Lead Free<br/>G: Halogen Free</p> |  <p>Lot Code ← [●] [ ] [ ] [ ] [ ] → Date Code</p> |
| <p>TOLL-8A / TOLL-8B</p>   | <p>-</p>   |
|  <p>Lot Code ← [ ] [ ] [ ] [ ] → Date Code</p> <p>1</p> <p>L: Lead Free<br/>G: Halogen Free</p> | <p>-</p>   |

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

| PARAMETER                          |                                       | SYMBOL    | RATINGS    | UNIT             |
|------------------------------------|---------------------------------------|-----------|------------|------------------|
| Drain-Source Voltage               |                                       | $V_{DSS}$ | 600        | V                |
| Gate-Source Voltage                |                                       | $V_{GSS}$ | $\pm 30$   | V                |
| Drain Current                      | Continuous ( $T_C=25^\circ\text{C}$ ) | $I_D$     | 33         | A                |
|                                    | Pulsed (Note 2)                       | $I_{DM}$  | 99         | A                |
| Avalanche Energy                   | Single Pulsed (Note 3)                | $E_{AS}$  | 435        | mJ               |
| Peak Diode Recovery dv/dt (Note 4) |                                       | dv/dt     | 1.2        | V/ns             |
| Power Dissipation                  | TO-220/TO-263                         | $P_D$     | 118        | W                |
|                                    | TO-220F1/TO-220WF                     |           | 41         | W                |
|                                    | TO-247                                |           | 142        | W                |
|                                    | TO-3PN                                |           | 155        | W                |
|                                    | DFN8080-4                             |           | 74         | W                |
|                                    | TOLL-8A/TOLL-8B                       |           | 220        | 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.  $L = 100\text{mH}$ ,  $I_{AS} = 2.95\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$ .

4.  $I_{SD} \leq 33\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$ .

■ THERMAL DATA

| PARAMETER           |                                    | SYMBOL        | RATINGS     | UNIT                      |
|---------------------|------------------------------------|---------------|-------------|---------------------------|
| Junction to Ambient | TO-220/TO-220F1<br>TO-220WF/TO-263 | $\theta_{JA}$ | 62.5        | $^\circ\text{C}/\text{W}$ |
|                     | TO-247                             |               | 40          | $^\circ\text{C}/\text{W}$ |
|                     | TO-3PN                             |               | 30          | $^\circ\text{C}/\text{W}$ |
|                     | DFN8080-4/TOLL-8A<br>TOLL-8B       |               | 35          | $^\circ\text{C}/\text{W}$ |
| Junction to Case    | TO-220/TO-263                      | $\theta_{JC}$ | 1.05        | $^\circ\text{C}/\text{W}$ |
|                     | TO-220F1/TO-220WF                  |               | 3.05        | $^\circ\text{C}/\text{W}$ |
|                     | TO-247                             |               | 0.88        | $^\circ\text{C}/\text{W}$ |
|                     | TO-3PN                             |               | 0.8         | $^\circ\text{C}/\text{W}$ |
|                     | DFN8080-4                          |               | 1.68 (Note) | $^\circ\text{C}/\text{W}$ |
|                     | TOLL-8A/TOLL-8B                    |               | 0.56 (Note) | $^\circ\text{C}/\text{W}$ |

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

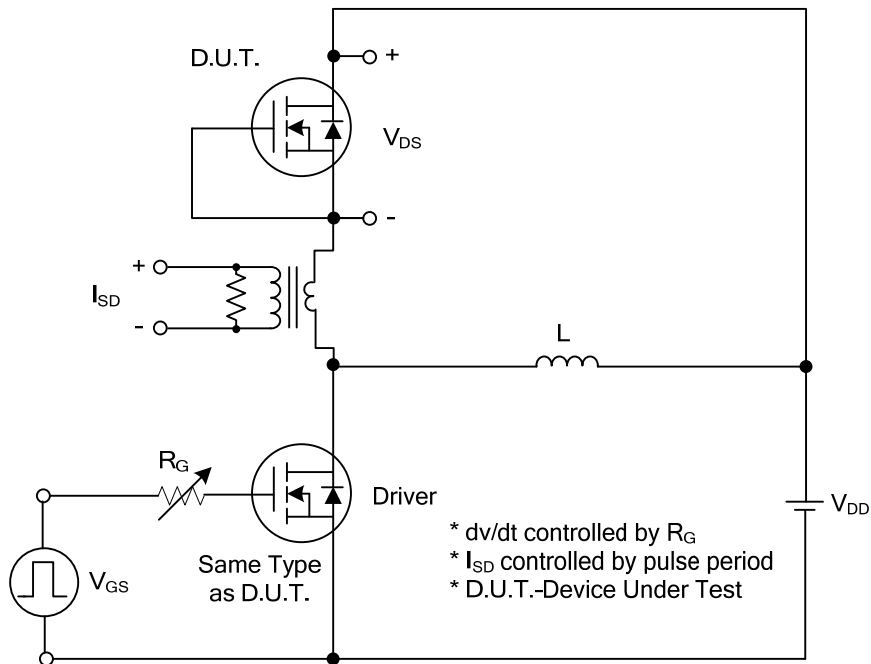
■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

| PARAMETER  | SYMBOL              | TEST CONDITIONS  | MIN | TYP  | MAX  | UNIT |
|--|---------------------|--|-----|------|------|------|
| <b>OFF CHARACTERISTICS</b>                             |                     |  |     |      |      |      |
| Drain-Source Breakdown Voltage                         | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA   | 600 |      |      | V    |
| Drain-Source Leakage Current                           | I <sub>DSS</sub>    | V <sub>DS</sub> =600V, V <sub>GS</sub> =0V   |     |      | 10   | μA   |
| Gate-Source Leakage Current                            | I <sub>GSS</sub>    | V <sub>GS</sub> =25V, V <sub>DS</sub> =0V  |     |      | 10   | μA   |
|  |                     | V <sub>GS</sub> =-20V, V <sub>DS</sub> =0V   |     |      | -10  | μA   |
| <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   | 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> =8.25A  |     |      | 130  | mΩ   |
| <b>DYNAMIC CHARACTERISTICS</b>                         |                     |  |     |      |      |      |
| Input Capacitance                                      | C <sub>ISS</sub>    | V <sub>GS</sub> =0V, V <sub>DS</sub> =50V, f=1MHz  |     | 1819 |      | pF   |
| Output Capacitance                                     | C <sub>OSS</sub>    |  |     | 494  |      | pF   |
| Reverse Transfer Capacitance                           | C <sub>RSS</sub>    |  |     | 11   |      | pF   |
| <b>SWITCHING CHARACTERISTICS</b>                       |                     |  |     |      |      |      |
| Total Gate Charge (Note 1)                             | Q <sub>G</sub>      | V <sub>DS</sub> =480V, V <sub>GS</sub> =10V, I <sub>D</sub> =33A<br>(Note 1, 2)                      |     | 77   |      | nC   |
| Gate-Source Charge                                     | Q <sub>GS</sub>     |  |     | 20   |      | nC   |
| Gate-Drain Charge                                      | Q <sub>DD</sub>     |  |     | 30   |      | nC   |
| Turn-On Delay Time (Note 1)                            | t <sub>D(ON)</sub>  | V <sub>DD</sub> =100V, V <sub>GS</sub> =10V, I <sub>D</sub> =33A,<br>R <sub>G</sub> =25Ω (Note 1, 2) |     | 30   |      | ns   |
| Turn-On Rise Time                                      | t <sub>R</sub>      |  |     | 34   |      | ns   |
| Turn-Off Delay Time                                    | t <sub>D(OFF)</sub> |  |     | 187  |      | ns   |
| Turn-Off Fall Time                                     | t <sub>F</sub>      |  |     | 116  |      | ns   |
| <b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b> |                     |  |     |      |      |      |
| Maximum Continuous Drain-Source Diode Forward Current  | I <sub>S</sub>      |  |     |      | 33   | A    |
| Drain-Source Diode Forward Voltage (Note 1)            | V <sub>SD</sub>     | I <sub>S</sub> =33A, V <sub>GS</sub> =0V   |     |      | 1.4  | V    |
| Body Diode Reverse Recovery Time (Note 1)              | t <sub>rr</sub>     | I <sub>S</sub> =30A, V <sub>GS</sub> =0V,<br>dI <sub>F</sub> /dt=100A/μs                             |     | 460  |      | ns   |
| Body Diode Reverse Recovery Charge                     | Q <sub>rr</sub>     |  |     |      | 8140 |      |

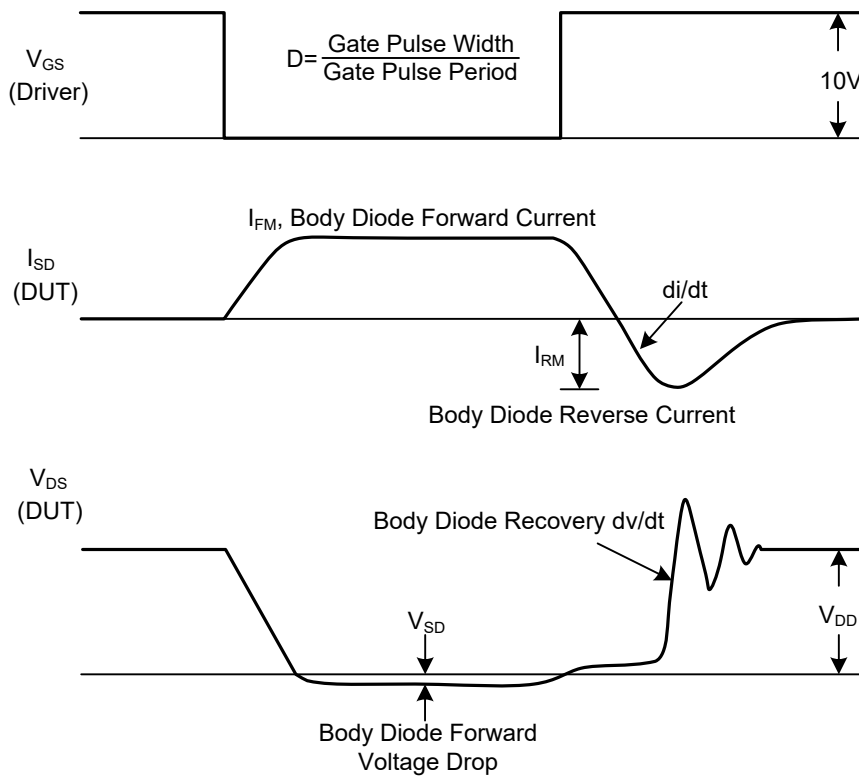
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

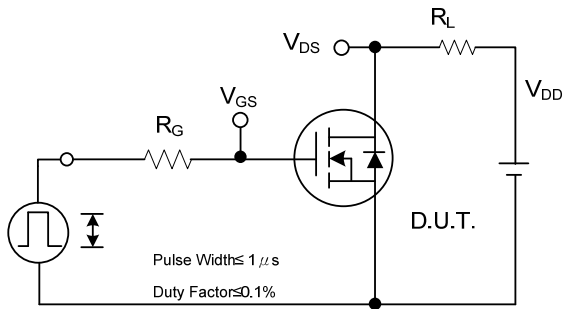


Peak Diode Recovery dv/dt Test Circuit

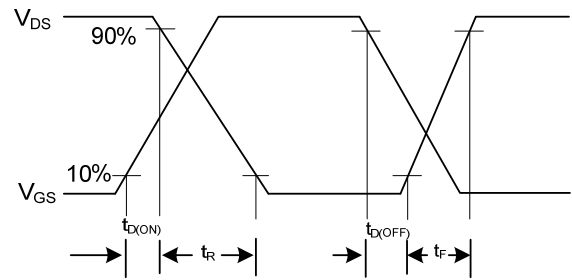


Peak Diode Recovery dv/dt Waveforms

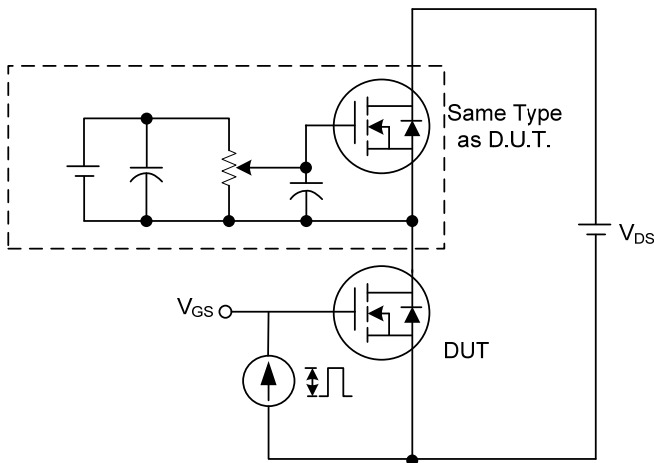
### TEST CIRCUITS AND WAVEFORMS



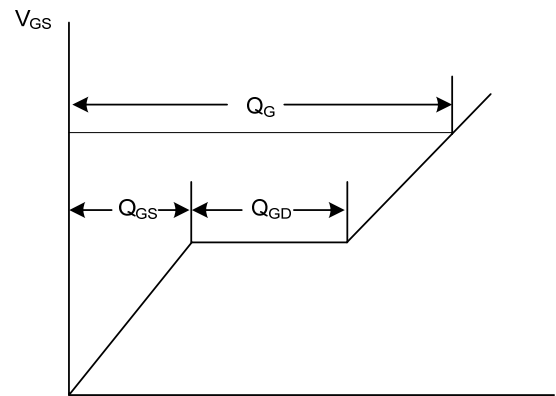
Switching Test Circuit



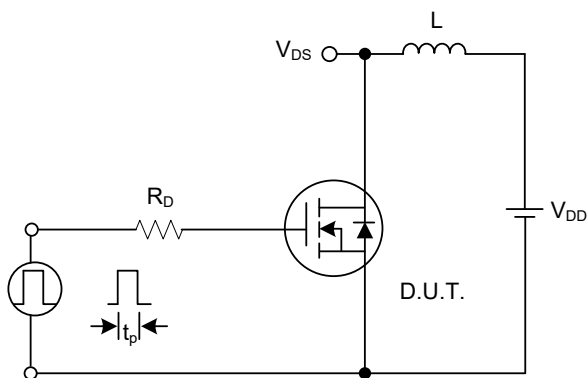
Switching Waveforms



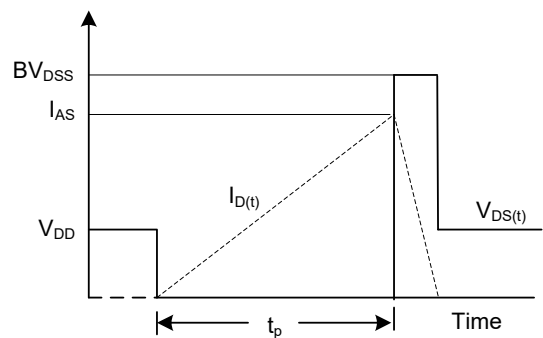
Gate Charge Test Circuit



Charge  
Gate Charge Waveform

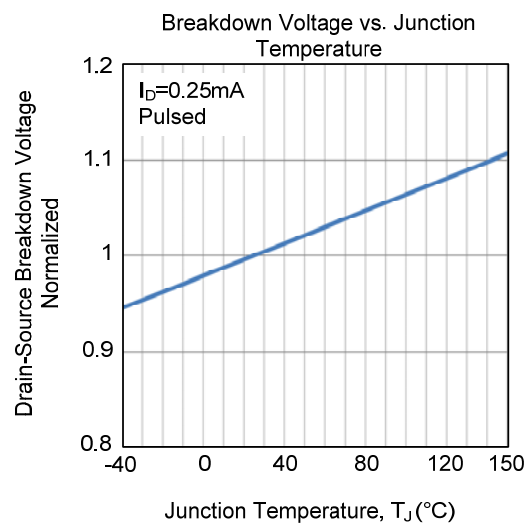
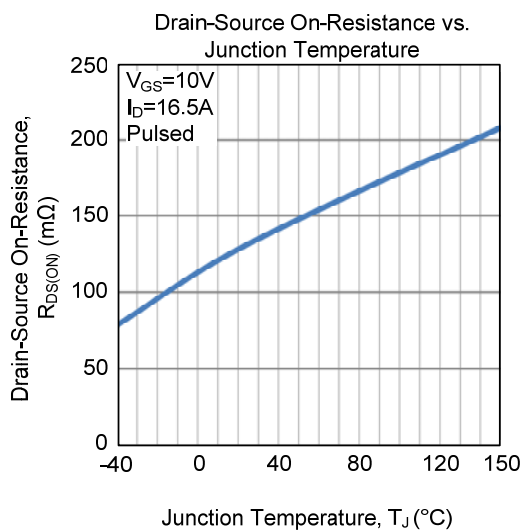
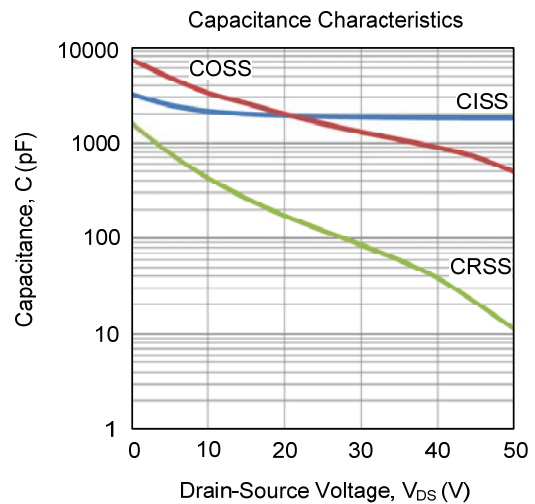
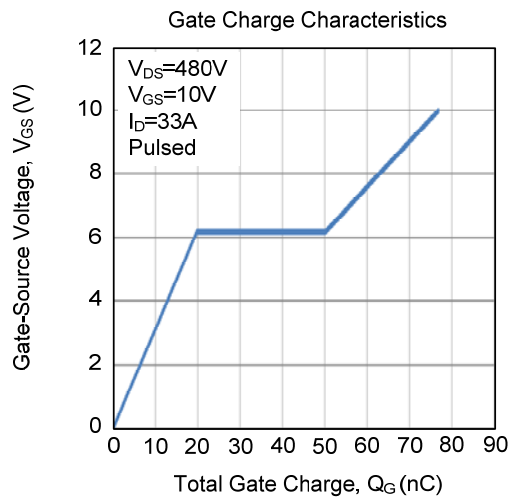
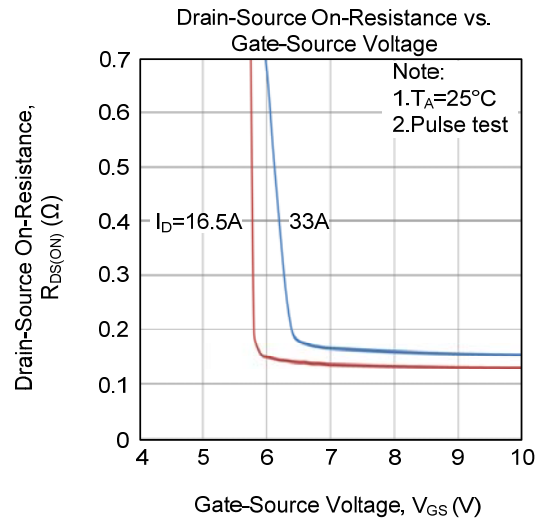
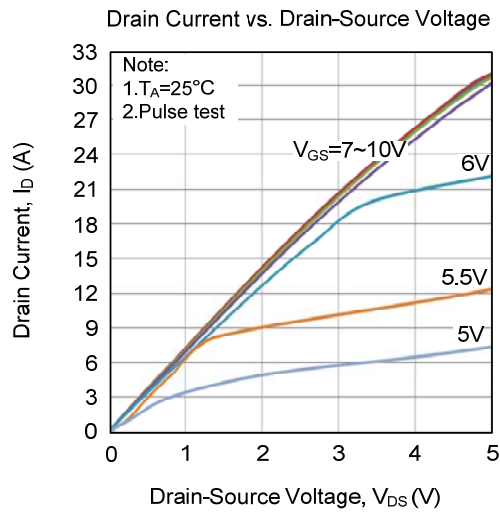


Unclamped Inductive Switching Test Circuit

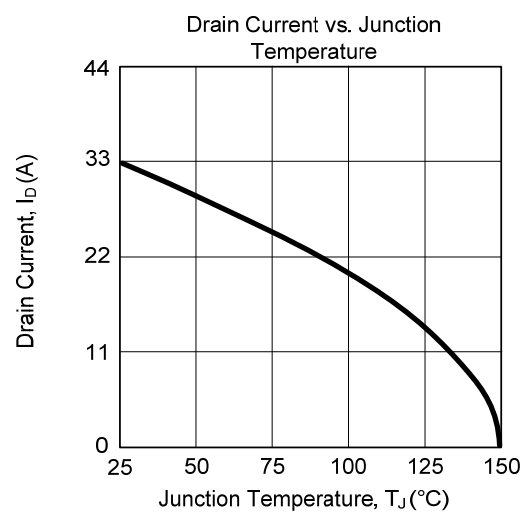
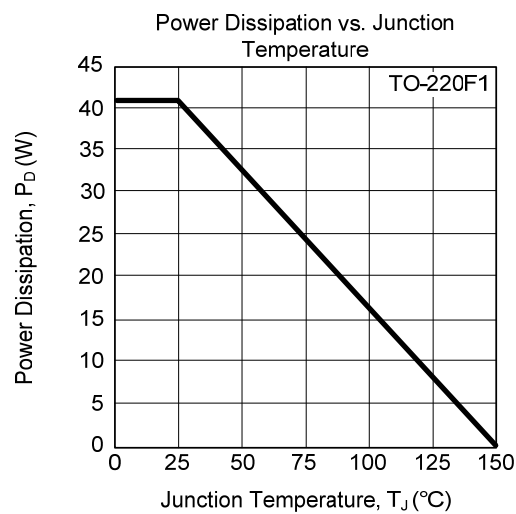
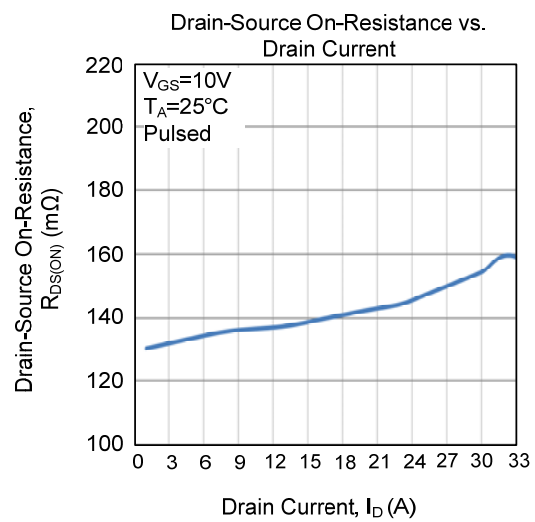
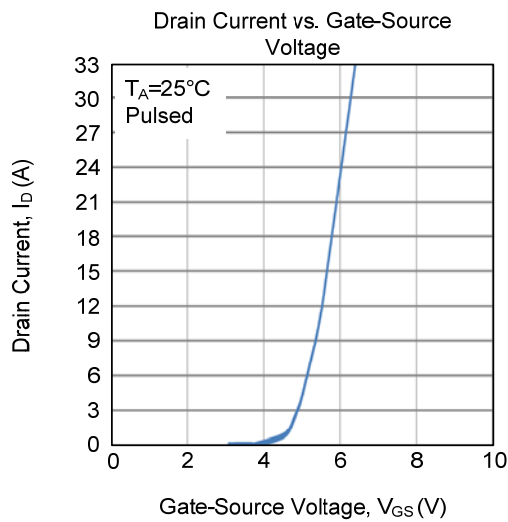
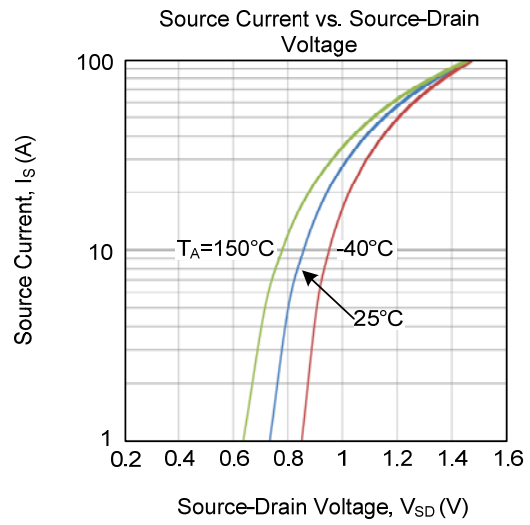
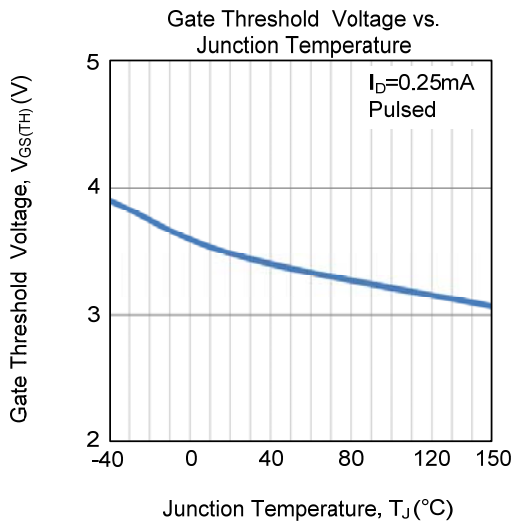


Unclamped Inductive Switching Waveforms

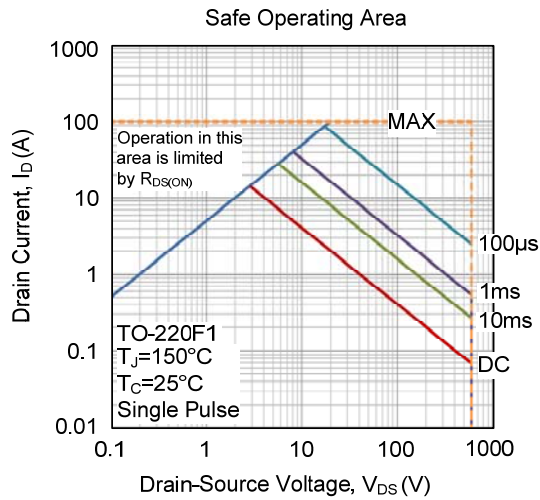
## TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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