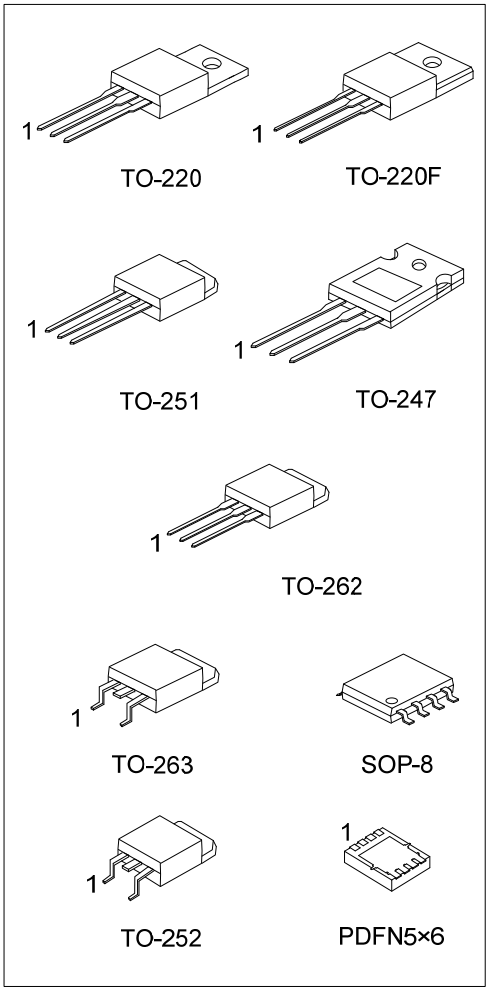
# UTT60N10M

**POWER MOSFET**

## 60A, 100V N-CHANNEL ENHANCEMENT MODE TRENCH POWER MOSFET




### ■ DESCRIPTION

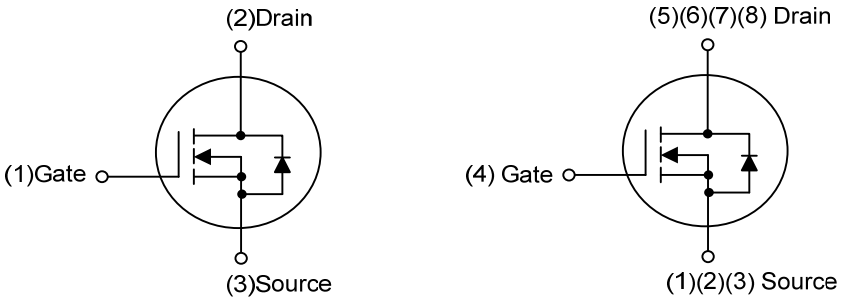
The UTC **UTT60N10M** is N-channel enhancement mode power MOSFET using UTC's advanced technology to provide customers with high switching speed, a extremely low $R_{DS(ON)}$ and low gate charge.

The UTC **UTT60N10M** is suitable for high frequency Point -of-Load Synchronous, Networking DC-DC System, CCFL Back-light Inverter, etc.

### ■ FEATURES

* $R_{DS(ON)} \leq 18\ m\Omega$ @ $V_{GS}$=10V, $I_D$=30A
  $R_{DS(ON)} \leq 25\ m\Omega$ @ $V_{GS}$=4.5V, $I_D$=15A
* Green Device Available
* Low Gate Charge
* Surface mount package

### ■ SYMBOL



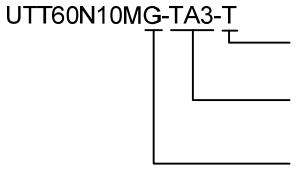

TO-220 / TO-220F
TO-251 / TO-252
TO-262 / TO-263 / TO-247

PDFN5×6

## ■ ORDERING INFORMATION

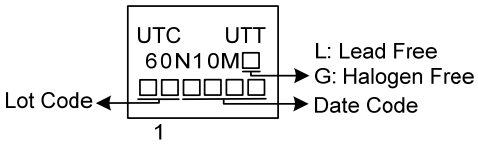
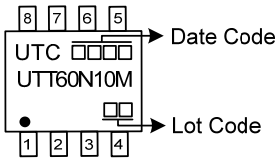
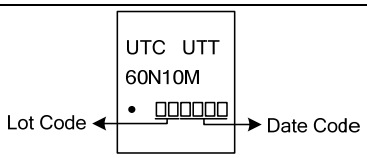
| Ordering Number | | Package | Pin Assignment | | | | | | | | Packing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| UTT60N10ML-TA3-T | UTT60N10MG-TA3-T | TO-220 | G | D | S | - | - | - | - | - | Tube |
| UTT60N10ML-TF3-T | UTT60N10MG-TF3-T | TO-220F | G | D | S | - | - | - | - | - | Tube |
| UTT60N10ML-TM3-T | UTT60N10MG-TM3-T | TO-251 | G | D | S | - | - | - | - | - | Tube |
| UTT60N10ML-TN3-R | UTT60N10MG-TN3-R | TO-252 | G | D | S | - | - | - | - | - | Tape Reel |
| UTT60N10ML-T2Q-T | UTT60N10MG-T2Q-T | TO-262 | G | D | S | - | - | - | - | - | Tube |
| UTT60N10ML-TQ2-T | UTT60N10MG-TQ2-T | TO-263 | G | D | S | - | - | - | - | - | Tube |
| UTT60N10ML-TQ2-R | UTT60N10MG-TQ2-R | TO-263 | G | D | S | - | - | - | - | - | Tape Reel |
| UTT60N10ML-T47-T | UTT60N10MG-T47-T | TO-247 | G | D | S | - | - | - | - | - | Tube |
| UTT60N10ML-S08-R | UTT60N10MG-S08-R | SOP-8 | S | S | S | G | D | D | D | D | Tape Reel |
| UTT60N10ML-P5060-R | UTT60N10MG-P5060-R | PDFN5×6 | S | S | S | G | D | D | D | D | Tape Reel |

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




(1) T: Tube, R: Tape Reel
(2) TA3: TO-220, TF3: TO-220F, TM3: TO-251, TN3: TO-252, T47: TO-247, S08: SOP-8, T2Q: TO-262, TQ2: TO-263, P5060: PDFN5×6
(3) G: Halogen Free and Lead Free, L: Lead Free

## ■ MARKING

| Package | Marking |
|---|---|
| TO-220 / TO-220F<br>TO-247 / TO-251 / TO-252 |  |
| SOP-8 |  |
| PDFN5×6 |  |

## ■ ABSOLUTE MAXIMUM RATING ($T_C$ = 25°C, unless otherwise specified)

| PARAMETER | | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 100 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±20 | V |
| Drain Current | Continuous | TO-220/TO-220F<br>TO-251/TO-252 | $I_D$ | 60 | A |
| | | SOP-8 | | 30 | A |
| | | PDFN5×6 | | 40 | A |
| | Pulsed (Note 2) | TO-220/TO-220F<br>TO-251/TO-252 | $I_{DM}$ | 100 | A |
| | | SOP-8 | | 50 | A |
| | | PDFN5×6 | | 67 | A |
| Avalanche Current | | | $I_{AS}$ | 20 | A |
| Avalanche Energy (Note 3) | | | $E_{AS}$ | 200 | mJ |
| Power Dissipation | | TO-220/TO-262<br>TO-263 | $P_D$ | 125 | W |
| | | TO-220F | | 30 | W |
| | | TO-247 | | 312 | W |
| | | TO-251/TO-252 | | 50 | W |
| | | SOP-8 | | 6 | W |
| | | PDFN5×6 | | 14 | W |
| Junction Temperature | | | $T_J$ | -40 ~ +150 | °C |
| Storage Temperature Range | | | $T_{STG}$ | -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 = 1mH, $I_{AS}$ = 20A, $V_{DD}$ = 25V, $R_G$ = 25Ω, Starting $T_J$ = 25°C

## ■ THERMAL DATA

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Junction to Ambient | TO-220/TO-220F<br>TO-247/TO-262<br>TO-263 | $\theta_{JA}$ | 62.5 | °C/W |
| | TO-251/TO-252 | | 110 | °C/W |
| | SOP-8 | | 90 (Note) | °C/W |
| | PDFN5×6 | | 65 (Note) | °C/W |
| Junction to Case | TO-220/TO-262<br>TO-263 | $\theta_{JC}$ | 1 | °C/W |
| | TO-220F | | 4.17 | °C/W |
| | TO-247 | | 0.4 | °C/W |
| | TO-251/TO-252 | | 2.5 (Note) | °C/W |
| | SOP-8 | | 20.8 (Note) | °C/W |
| | PDFN5×6 | | 8.93 (Note) | °C/W |

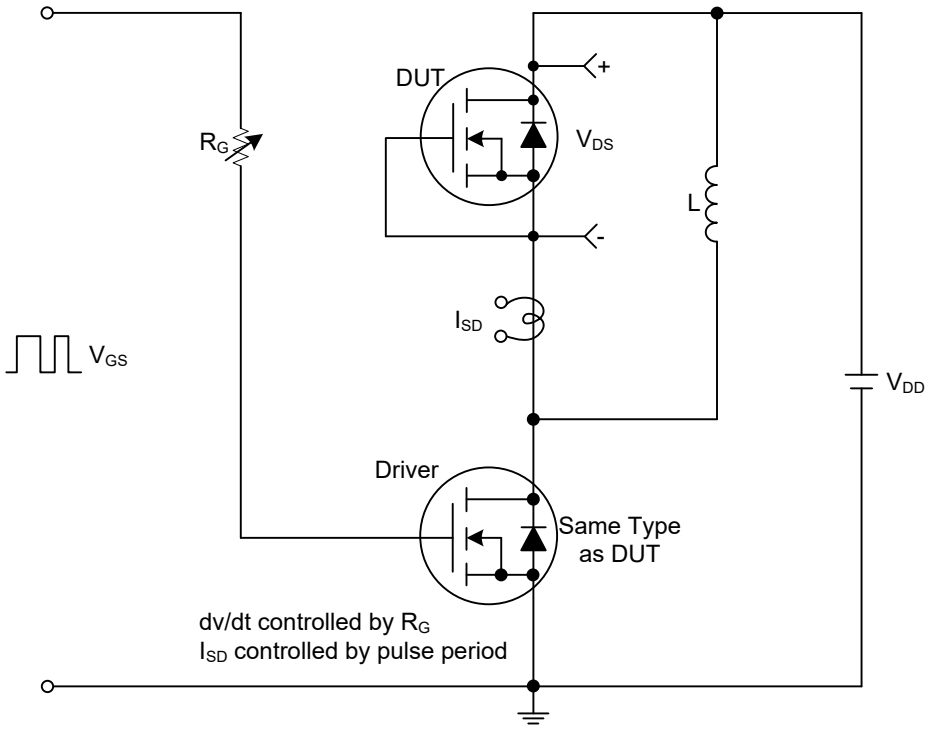
Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

■ ELECTRICAL CHARACTERISTICS ($T_J$ = 25°C, unless otherwise specified)

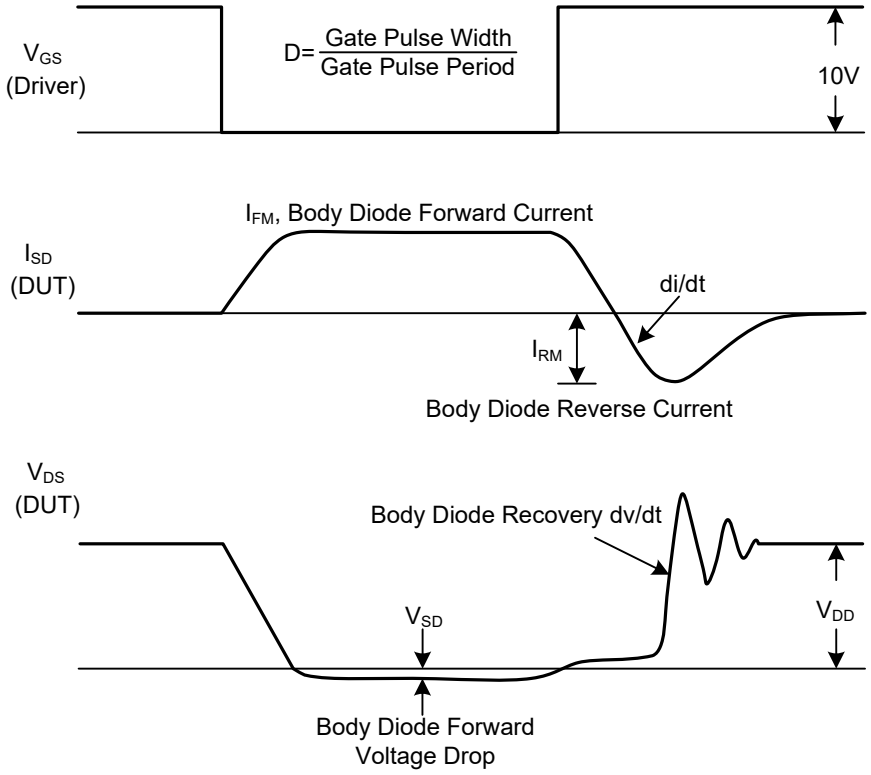
| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $I_D$=250μA, $V_{GS}$=0V | 100 | | | V |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$=100V, $V_{GS}$=0V,$T_J$=25°C | | | 1 | μA |
| Gate-Source Leakage Current | Forward | $I_{GSS}$ | $V_{GS}$=+20V, $V_{DS}$=0V | | | +100 | nA |
| | Reverse | | $V_{GS}$=-20V, $V_{DS}$=0V | | | -100 | nA |
| **ON CHARACTERISTICS** | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 1.0 | | 3.0 | V |
| Static Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=30A | | | 18 | mΩ |
| | | | $V_{GS}$=4.5V, $I_D$=15A | | | 25 | mΩ |
| Forward Transconductance | | $g_{FS}$ | $V_{DS}$=-10V, $I_D$=-20A | | 30 | | S |
| **DYNAMIC PARAMETERS** | | | | | | | |
| Input Capacitance | | $C_{ISS}$ | $V_{GS}$=0V, $V_{DS}$=25V, f=1.0MHz | | 5500 | | pF |
| Output Capacitance | | $C_{OSS}$ | | | 250 | | pF |
| Reverse Transfer Capacitance | | $C_{RSS}$ | | | 160 | | pF |
| Gate Resistance | | $R_G$ | $V_{DS}$=0V, f=1.0MHz | | 1 | | Ω |
| **SWITCHING PARAMETERS** | | | | | | | |
| Total Gate Charge (Note 1) | | $Q_G$ | $V_{DS}$=80V, $V_{GS}$=10V, $I_D$=60A $I_G$= 1mA (Note1, 2) | | 100 | | nC |
| Gate to Source Charge | | $Q_{GS}$ | | | 12 | | nC |
| Gate to Drain Charge | | $Q_{GD}$ | | | 18 | | nC |
| Turn-on Delay Time (Note 1) | | $t_{D(ON)}$ | $V_{DS}$=50V, $V_{GS}$=10V, $I_D$=60A, $R_G$=3Ω (Note1, 2) | | 12 | | ns |
| Rise Time | | $t_R$ | | | 17 | | ns |
| Turn-off Delay Time | | $t_{D(OFF)}$ | | | 64 | | ns |
| Fall-Time | | $t_F$ | | | 20 | | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | | |
| Maximum Body-Diode Continuous Current | | $I_S$ | | | | 60 | A |
| Forward On Voltage (Note 1) | | $V_{SD}$ | $I_S$=60A, $V_{GS}$=0V | | | 1.2 | V |
| Reverse Recovery Time (Note 1) | | $t_{rr}$ | $I_S$=30A, $V_{GS}$=0V, dI/dt=100A/μs | | 100 | | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | | | 210 | | nC |

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

## ■ TEST CIRCUITS AND WAVEFORMS



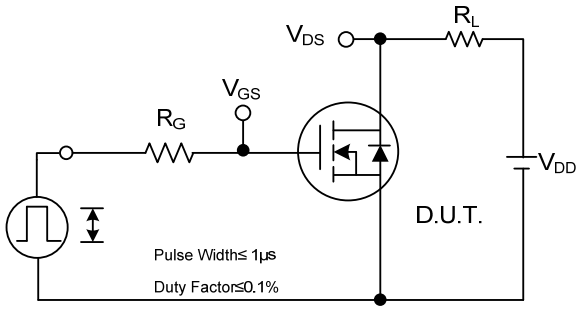

**Peak Diode Recovery dv/dt Test Circuit**



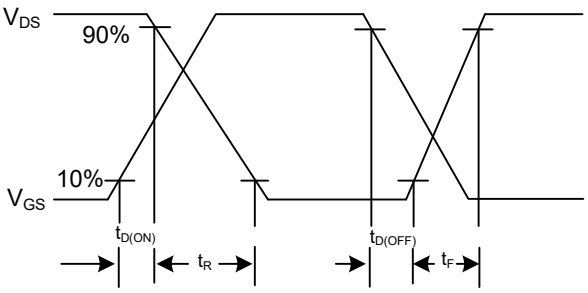

Peak Diode Recovery dv/dt Test Circuit and Waveforms

**Peak Diode Recovery dv/dt Waveforms**

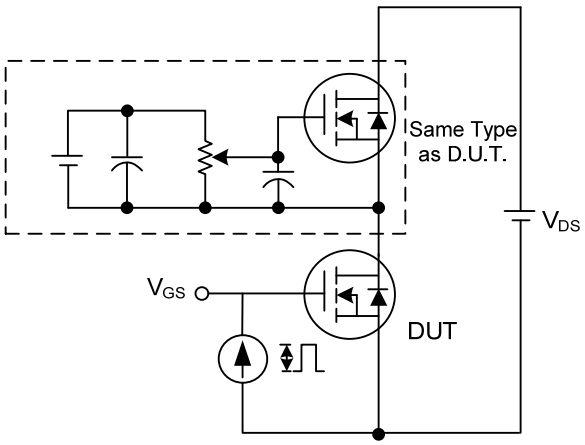
## ■ TEST CIRCUITS AND WAVEFORMS



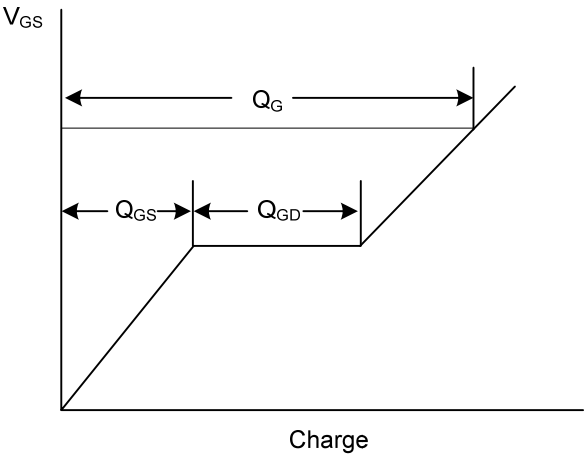

**Switching Test Circuit**



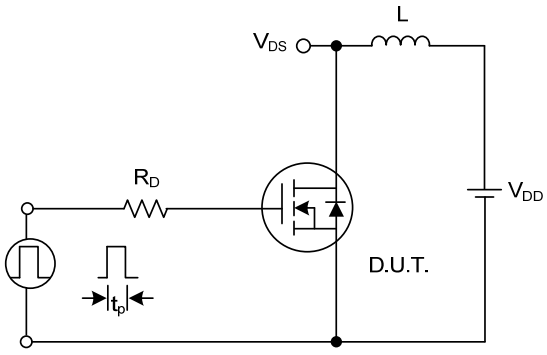

**Switching Waveforms**



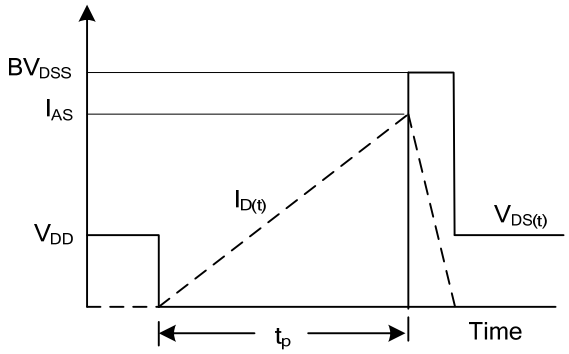

**Gate Charge Test Circuit**




**Gate Charge Waveform**

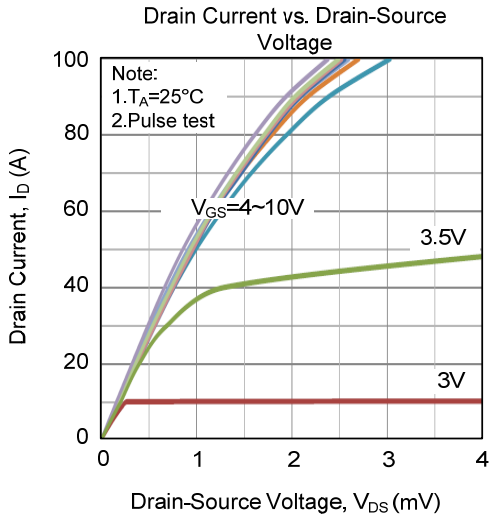


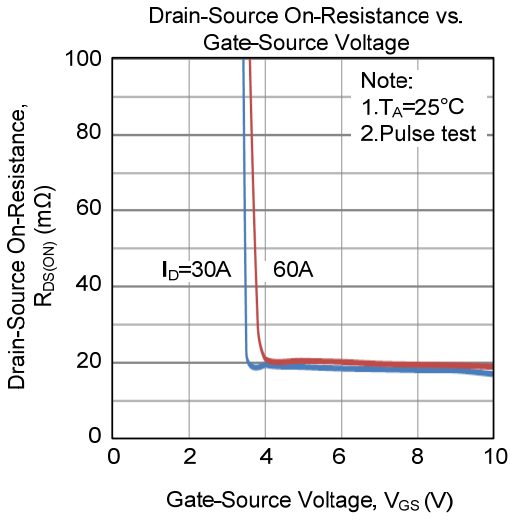

**Unclamped Inductive Switching Test Circuit**

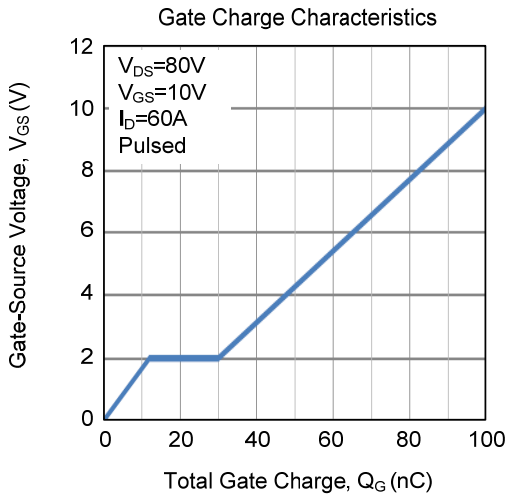


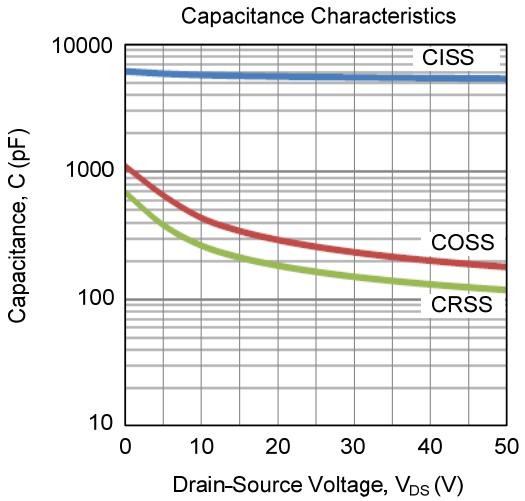

**Unclamped Inductive Switching Waveforms**

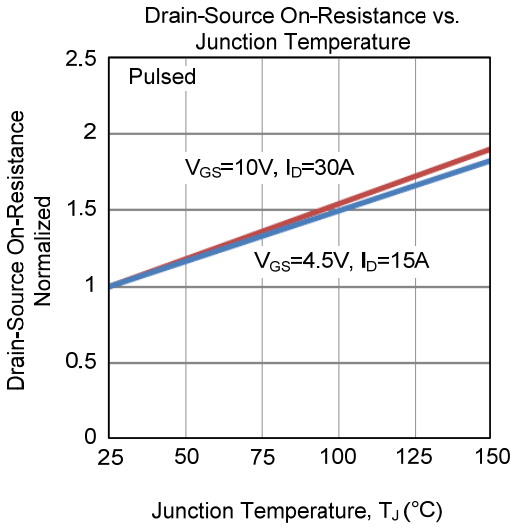
## ■ TYPICAL CHARACTERISTICS

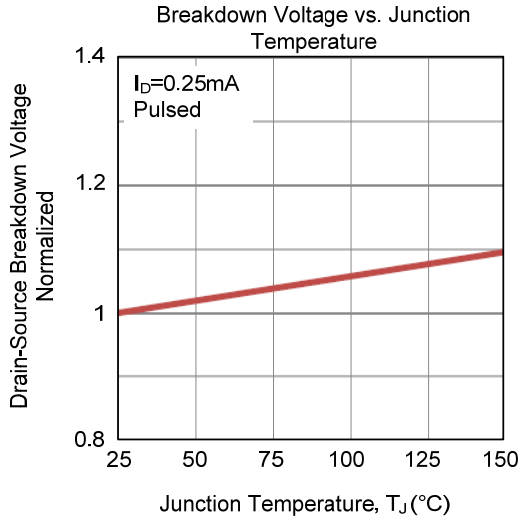


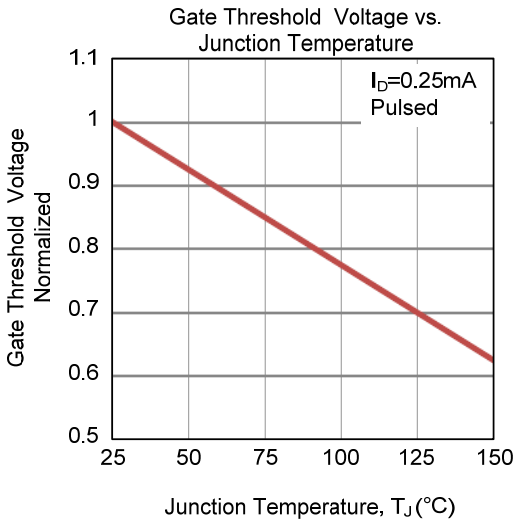



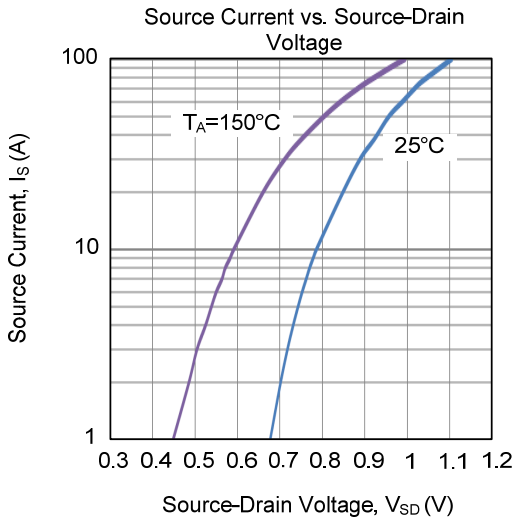



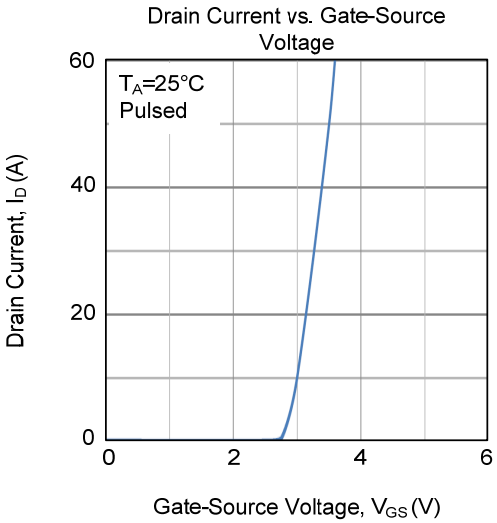



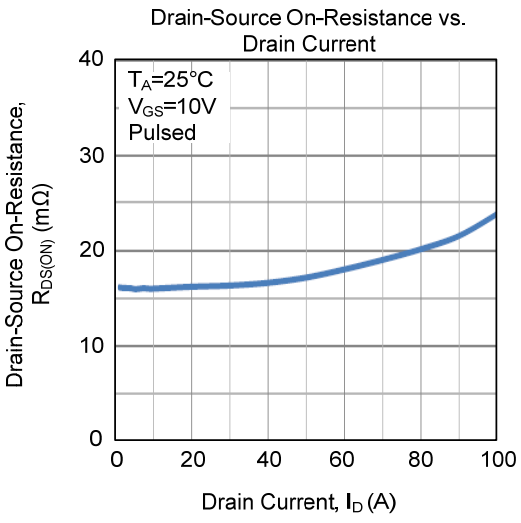



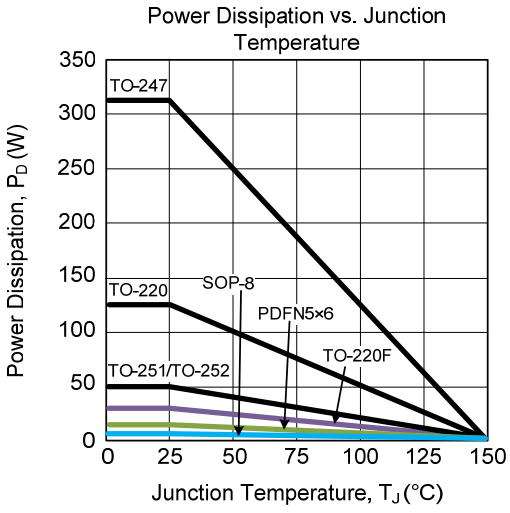
## ■ TYPICAL CHARACTERISTICS (Cont.)

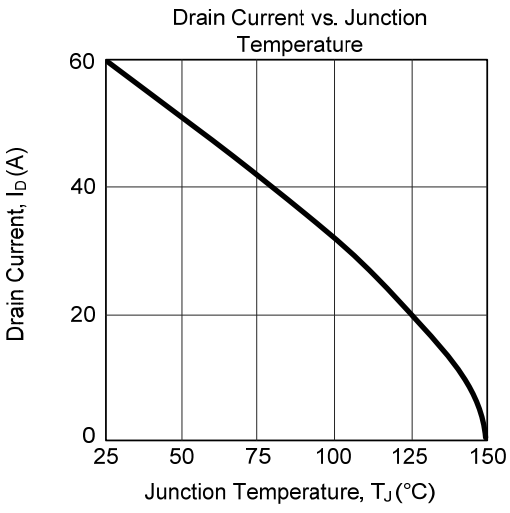


■ TYPICAL CHARACTERISTICS (Cont.)