



2N65-LC1

Power MOSFET

2A, 650V N-CHANNEL POWER MOSFET

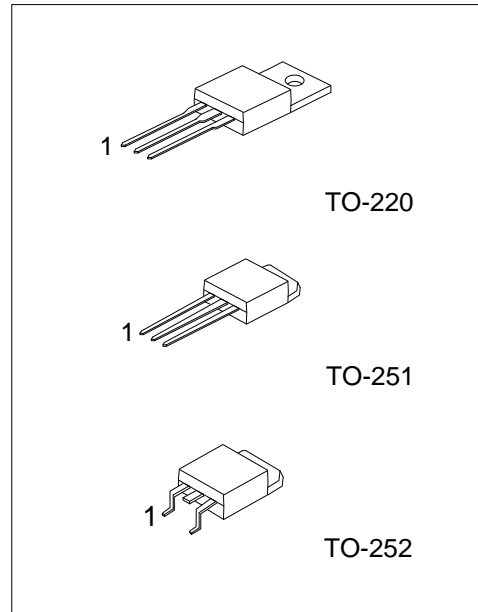
DESCRIPTION

The UTC **2N65-LC1** is an N-channel power MOSFET using UTC's advanced technology to provide customers with a minimum on-state resistance and superior switching performance.

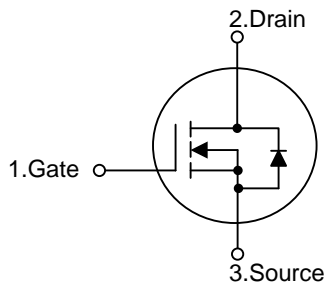
The UTC **2N65-LC1** is generally applied in low power switching mode power appliances and electronic ballast.

FEATURES

- * $R_{DS(ON)} \leq 5.5 \Omega @ V_{GS}=10V, I_D=1.0A$
- * High Switching Speed
- * 100% Avalanche Tested



SYMBOL



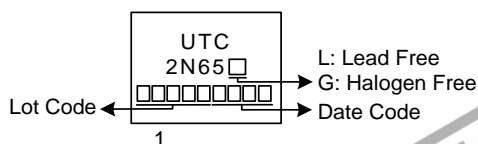
ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|-----------------|--------------|---------|----------------|---|---|-----------|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| 2N65L-TA3-T | 2N65G-TA3-T | TO-220 | G | D | S | Tube |
| 2N65L-TM3-T | 2N65G-TM3-T | TO-251 | G | D | S | Tube |
| 2N65L-TN3-R | 2N65G-TN3-R | TO-252 | G | D | S | Tape Reel |

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

| | |
|---|--|
| <p>2N65G-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, TM3: TO-251, TN3: TO-252</p> <p>(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} | ± 30 | V |
| Drain Current | Continuous | I_D | 2 | A |
| | Pulsed (Note 2) | I_{DM} | 4 | A |
| Avalanche Energy | Single Pulsed (Note 3) | E_{AS} | 28.8 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 2.175 | V/ns |
| Power Dissipation | TO-220 | P_D | 54 | W |
| | TO-251/TO-252 | | 45 | 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. $L = 10\text{mH}$, $I_{AS} = 2.4\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 2.0\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ **THERMAL DATA**

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---------------------|---------------|---------------|-------------|---------------------------|
| Junction to Ambient | TO-220 | θ_{JA} | 62.5 | $^\circ\text{C}/\text{W}$ |
| | TO-251/TO-252 | | 110 | $^\circ\text{C}/\text{W}$ |
| Junction to Case | TO-220 | θ_{JC} | 2.31 | $^\circ\text{C}/\text{W}$ |
| | TO-251/TO-252 | | 2.77 (Note) | $^\circ\text{C}/\text{W}$ |

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

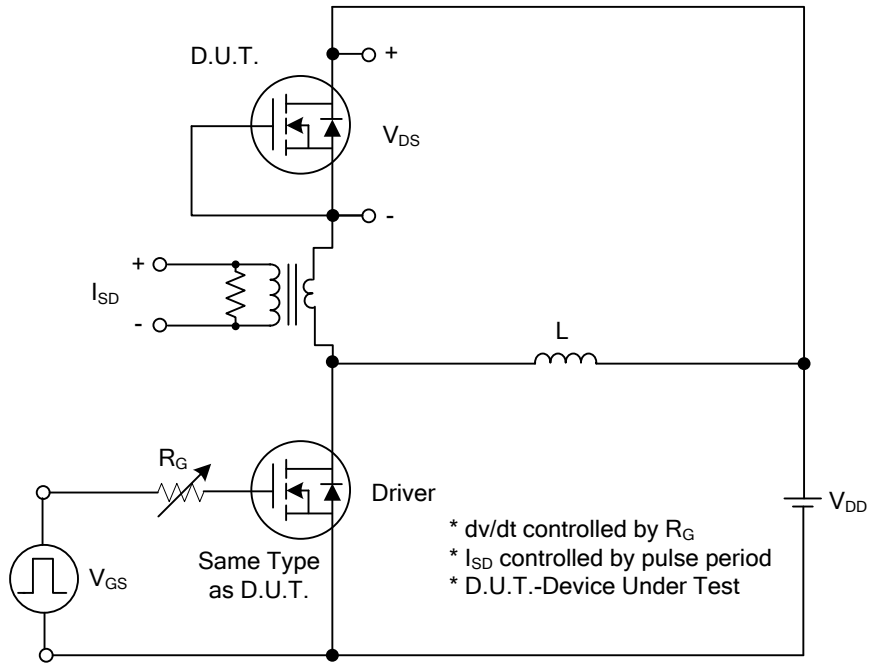
ELECTRICAL CHARACTERISTICS ($T_J=25^\circ\text{C}$, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|--------------|--|-----|------|------|---------------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$ | 650 | | | V |
| Drain-Source Leakage Current | I_{DSS} | $V_{DS}=650\text{V}$, $V_{GS}=0\text{V}$ | | | 10 | μA |
| Gate- Source Leakage Current | Forward | $V_{GS}=+30\text{V}$, $V_{DS}=0\text{V}$ $V_{GS}=-30\text{V}$, $V_{DS}=0\text{V}$ | | | +100 | nA |
| | Reverse | | | | -100 | nA |
| ON CHARACTERISTICS | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$ | 2.0 | | 4.0 | V |
| Static Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}=10\text{V}$, $I_D=1.0\text{A}$ | | 4.7 | 5.5 | Ω |
| DYNAMIC PARAMETERS | | | | | | |
| Input Capacitance | C_{ISS} | $V_{GS}=0\text{V}$, $V_{DS}=25\text{V}$, $f=1.0\text{MHz}$ | | 263 | | pF |
| Output Capacitance | C_{OSS} | | | 30 | | pF |
| Reverse Transfer Capacitance | C_{RSS} | | | 2.9 | | pF |
| SWITCHING PARAMETERS | | | | | | |
| Total Gate Charge (Note 1) | Q_G | $V_{DS}=520\text{V}$, $V_{GS}=10\text{V}$, $I_D=2\text{A}$ $I_G=1\text{mA}$ (Note 1, 2) | | 7.5 | | nC |
| Gate to Source Charge | Q_{GS} | | | 2.9 | | nC |
| Gate to Drain Charge | Q_{GD} | | | 1 | | nC |
| Turn-ON Delay Time (Note 1) | $t_{D(ON)}$ | $V_{DD}=100\text{V}$, $V_{GS}=10\text{V}$, $I_D=2\text{A}$, $R_G=25\Omega$ (Note 1, 2) | | 3.8 | | ns |
| Rise Time | t_R | | | 15.5 | | ns |
| Turn-OFF Delay Time | $t_{D(OFF)}$ | | | 23 | | ns |
| Fall-Time | t_F | | | 24.5 | | ns |
| SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS | | | | | | |
| Maximum Body-Diode Continuous Current | I_S | | | | 2 | A |
| Maximum Body-Diode Pulsed Current (Note 1) | I_{SM} | | | | 4 | A |
| Drain-Source Diode Forward Voltage (Note 1) | V_{SD} | $I_S=2\text{A}$, $V_{GS}=0\text{V}$ | | | 1.4 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $I_S=2\text{A}$, $V_{GS}=0\text{V}$, $dI_F/dt=100\text{A}/\mu\text{s}$ | | 280 | | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | | 0.9 | | μC |

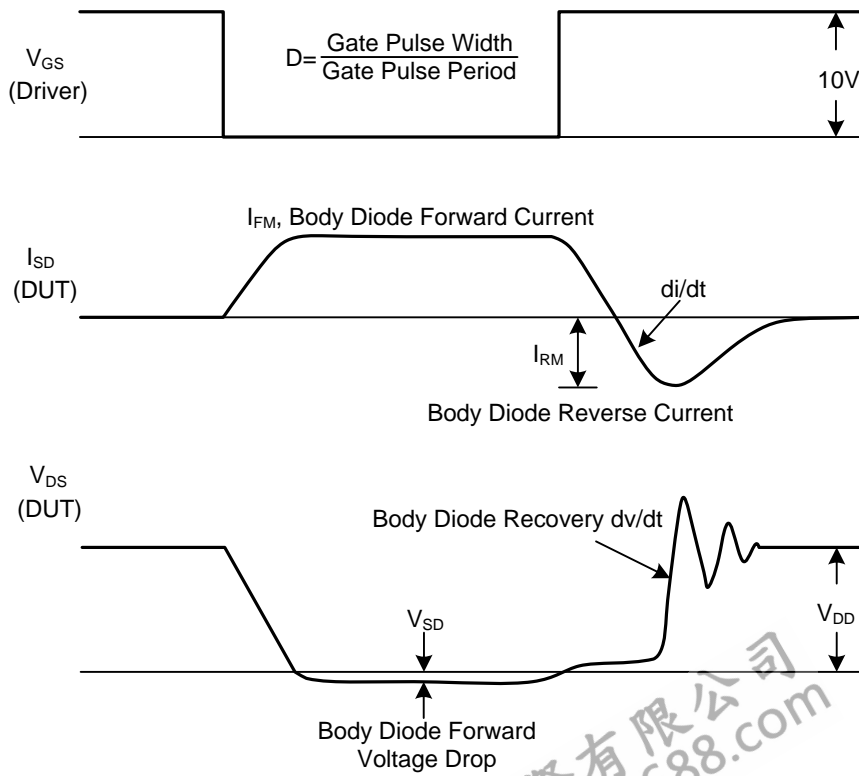
Notes: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

TEST CIRCUITS AND WAVEFORMS

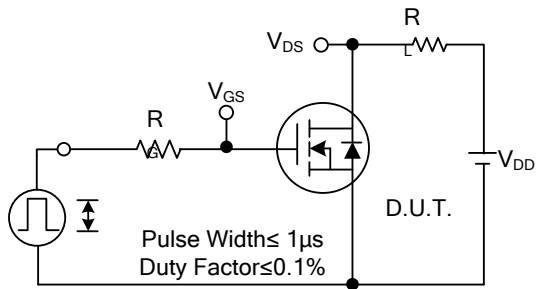


Peak Diode Recovery dv/dt Test Circuit

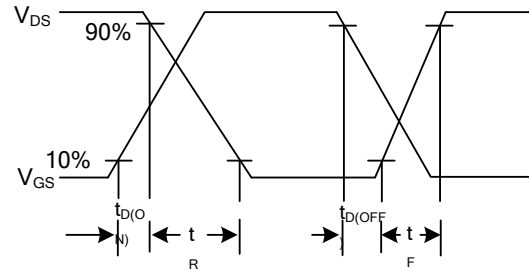


Peak Diode Recovery dv/dt Waveforms

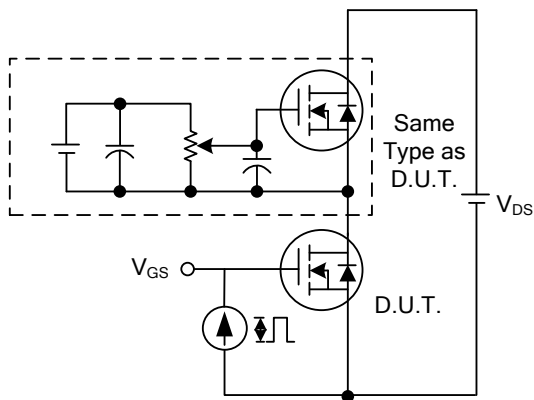
TEST CIRCUITS AND WAVEFORMS



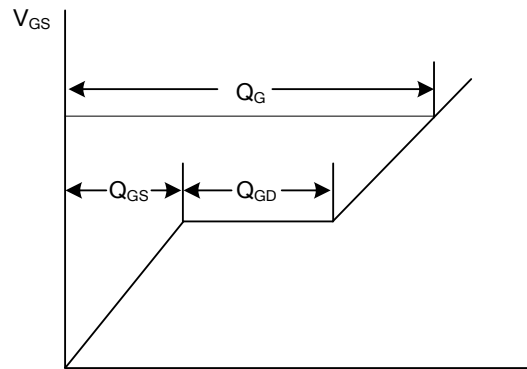
Switching Test Circuit



Switching Waveforms

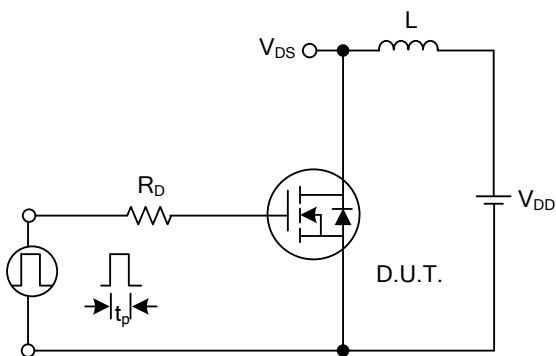


Gate Charge Test Circuit

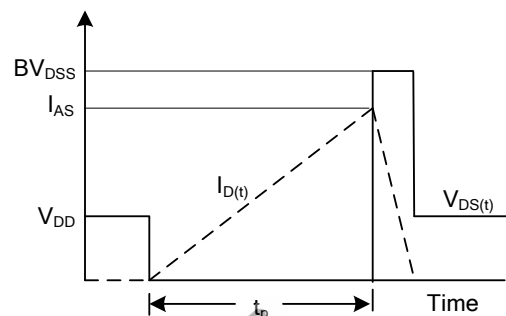


Charge

Gate Charge Waveform

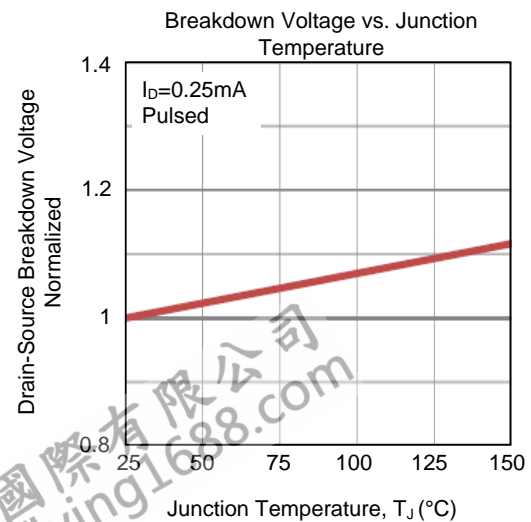
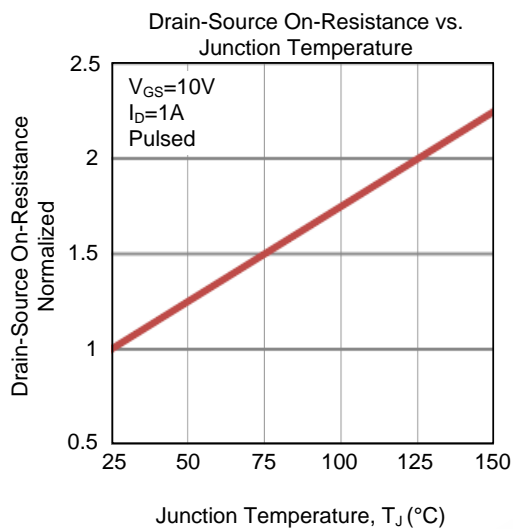
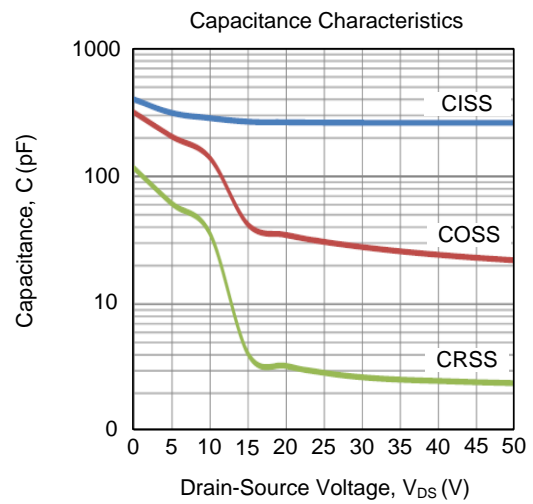
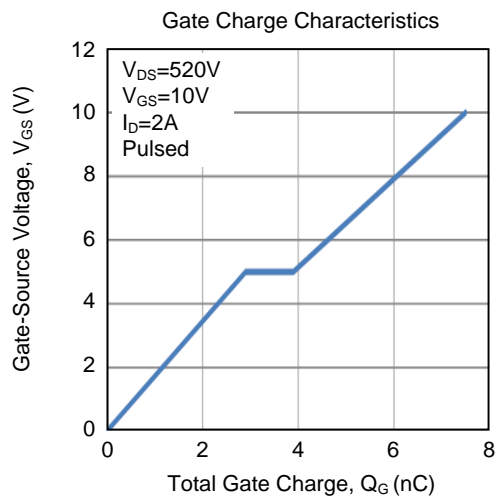
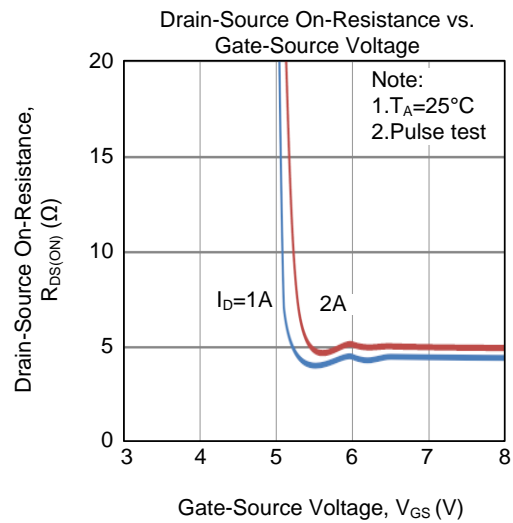
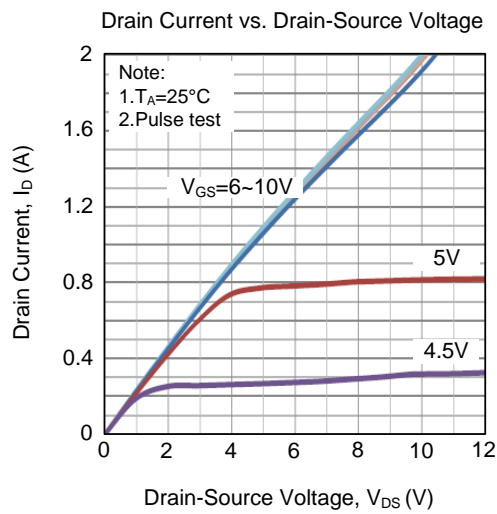


Unclamped Inductive Switching Test Circuit

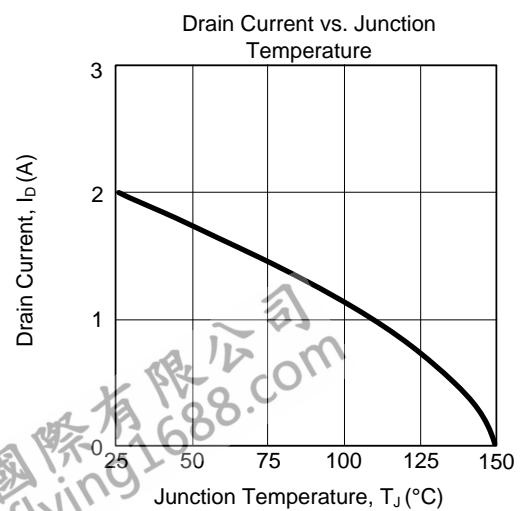
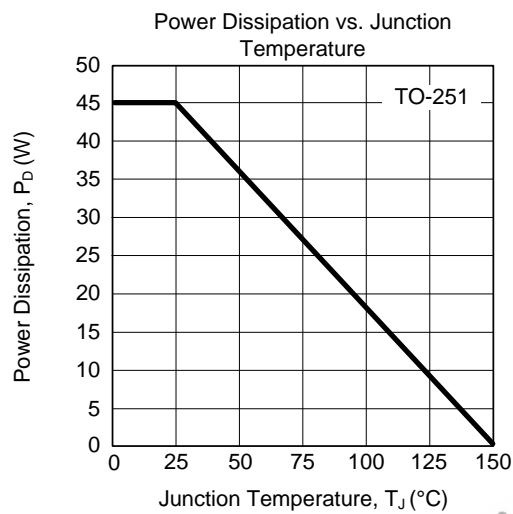
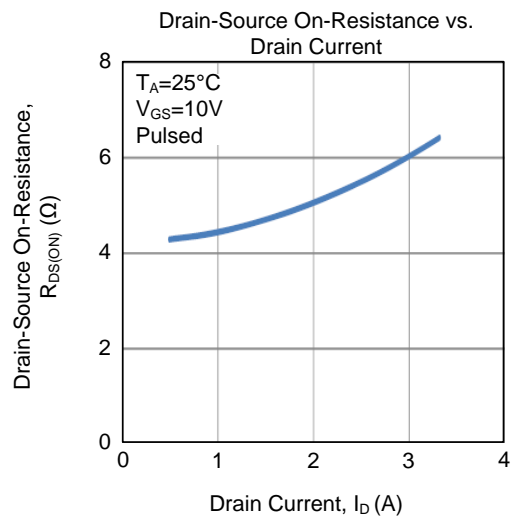
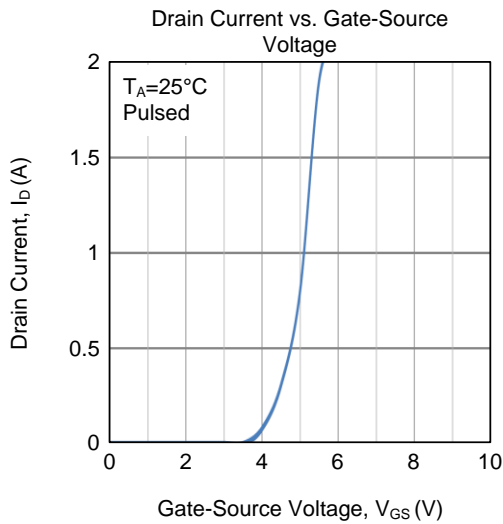
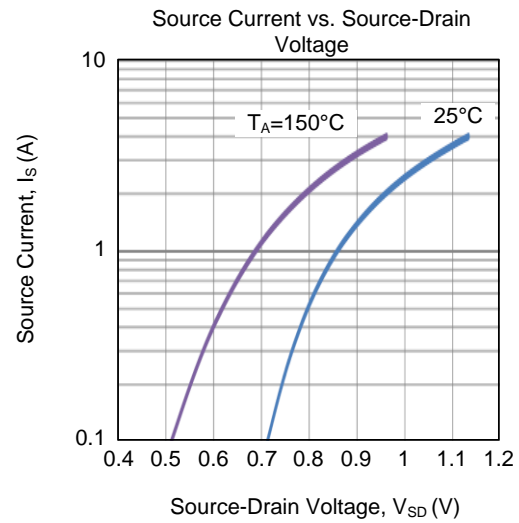
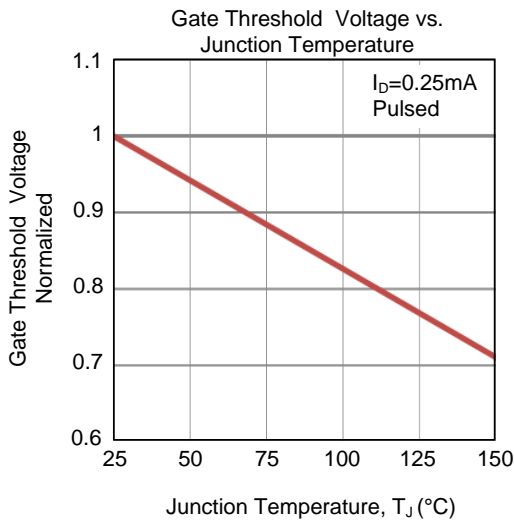


Unclamped Inductive Switching Waveforms

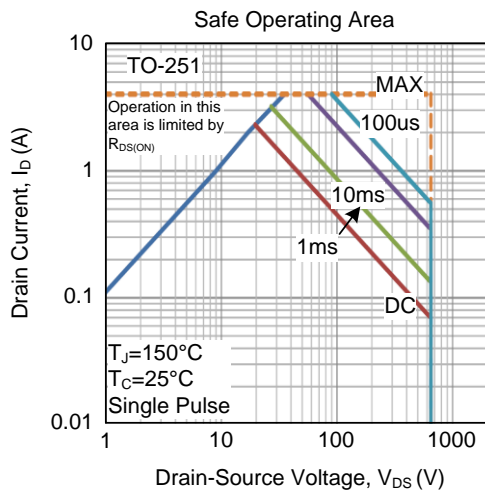
TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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