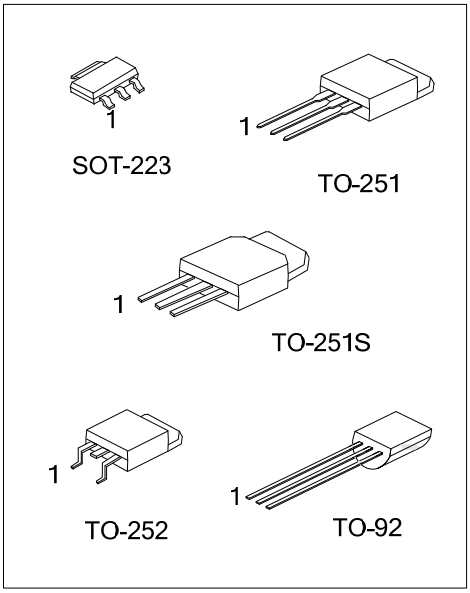
# 2A, 500V N-CHANNEL POWER MOSFET




## ■ DESCRIPTION

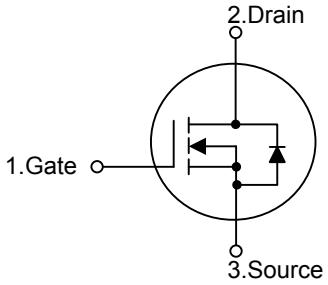
The UTC **2N50-CB** is an N-channel mode power MOSFET using UTC's advanced technology to provide customers with planar stripe and DMOS technology. This technology allows a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **2N50-CB** is generally applied in high efficiency switch mode power supplies, active power factor correction and electronic lamp ballasts based on half bridge topology.

## ■ FEATURES

* $R_{DS(ON)}$ < 5.0Ω @ $V_{GS}$=10V, $I_D$=1.0A
* High switching speed
* 100% avalanche tested

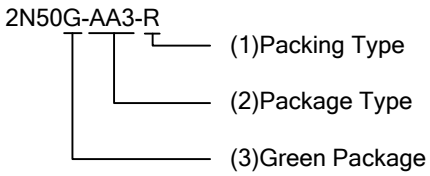
## ■ SYMBOL




## ■ ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| - | 2N50G-AA3-R | SOT-223 | G | D | S | Tape Reel |
| 2N50L-TM3-T | 2N50G-TM3-T | TO-251 | G | D | S | Tube |
| 2N50L-TMS-T | 2N50G-TMS-T | TO-251S | G | D | S | Tube |
| 2N50L-TN3-R | 2N50G-TN3-R | TO-252 | G | D | S | Tape Reel |
| 2N50L-T92-B | 2N50G-T92-B | TO-92 | G | D | S | Tape Box |
| 2N50L-T92-K | 2N50G-T92-K | TO-92 | G | D | S | Bulk |

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




(1) B: Tape Box, K: Bulk, T: Tube, R: Tape Reel
(2) AA3: SOT-223, TM3: TO-251, TMS: TO-251S
TN3: TO-252, T92: TO-92
(3) L: Lead Free, G: Halogen Free and Lead Free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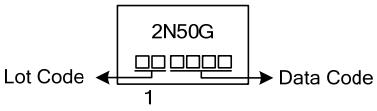
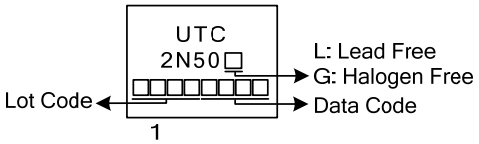
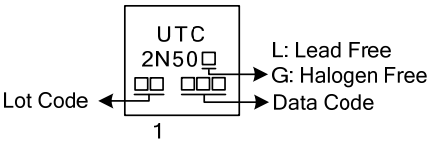
## ■ MARKING

| PACKAGE | MARKING |
|---|---|
| SOT-223 |   |
| TO-251 / TO-251S / TO-252 |   |
| TO-92 |   |

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

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 500 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±30 | V |
| Drain Current | Continuous | $I_D$ | 2.0 | A |
| | Pulsed (Note 2) | $I_{DM}$ | 8.0 | A |
| Avalanche Current (Note 2) | | $I_{AR}$ | 1.4 | A |
| Avalanche Energy | Single Pulsed | $E_{AS}$ | 10 | mJ |
| Power Dissipation | SOT-223 | $P_D$ | 8.9 | W |
| | TO-251/TO-251S TO-252 | | 50 | W |
| | TO-92 | | 1.42 | W |
| Junction Temperature | | $T_J$ | +150 | °C |
| Storage Temperature | | $T_{STG}$ | -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. Drain current limited by maximum junction temperature.
4. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.
5. L=10mH, $I_{AS}$=1.4A, $V_{DD}$=50V, $R_G$=25 Ω, Starting $T_J$ = 25°C.
6. $I_{SD}$≤2.0A, di/dt≤200A/μs, $V_{DD}$≤$BV_{DSS}$, Starting $T_J$=25°C.

## ■ THERMAL DATA

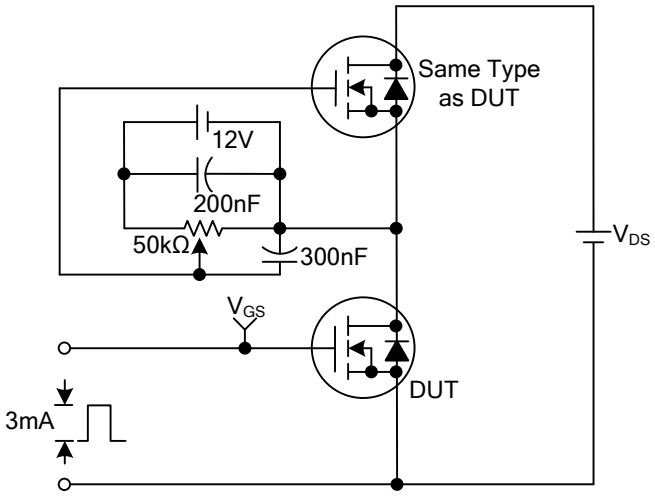
| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Junction to Ambient | SOT-223 | $\theta_{JA}$ | 150 | °C/W |
| | TO-251/TO-251S TO-252 | | 110 | °C/W |
| | TO-92 | | 160 | °C/W |
| Junction to Case | SOT-223 | $\theta_{JC}$ | 14 | °C/W |
| | TO-251/TO-251S TO-252 | | 2.5 | °C/W |
| | TO-92 | | 88 | °C/W |

## ■ ELECTRICAL CHARACTERISTICS ($T_C$=25°C, unless otherwise noted)

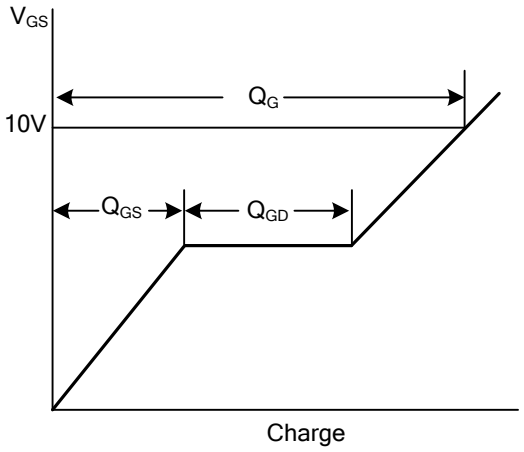
| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $I_D$=250μA, $V_{GS}$=0V | 500 | | | V |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$=500V, $V_{GS}$=0V | | | 1 | μA |
| Gate-Source Leakage Current | Forward | $I_{GSS}$ | $V_{GS}$=+30V, $V_{DS}$=0V | | | +100 | nA |
| | Reverse | | $V_{GS}$=-30V, $V_{DS}$=0V | | | -100 | nA |
| **ON CHARACTERISTICS** | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 2.0 | | 4.0 | V |
| Static Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=1A | | | 5.0 | Ω |
| **DYNAMIC PARAMETERS** | | | | | | | |
| Input Capacitance | | $C_{ISS}$ | $V_{GS}$=0V, $V_{DS}$=25V, f=1.0MHz | | 153 | | pF |
| Output Capacitance | | $C_{OSS}$ | | | 25.3 | | pF |
| Reverse Transfer Capacitance | | $C_{RSS}$ | | | 4.7 | | pF |
| **SWITCHING PARAMETERS** | | | | | | | |
| Total Gate Charge | | $Q_G$ | $V_{DS}$=50V, $V_{GS}$=10V, $I_D$=1.3A, $I_G$=250μA (Note 1, 2) | | 12.6 | | nC |
| Gate to Source Charge | | $Q_{GS}$ | | | 1.3 | | nC |
| Gate to Drain Charge | | $Q_{GD}$ | | | 0.8 | | nC |
| Turn-ON Delay Time | | $t_{D(ON)}$ | $V_{DD}$ =30V, $V_{GS}$=10V, $I_D$ =0.5A, $R_G$=25Ω (Note 1, 2) | | 26 | | ns |
| Rise Time | | $t_R$ | | | 18 | | ns |
| Turn-OFF Delay Time | | $t_{D(OFF)}$ | | | 62 | | ns |
| Fall-Time | | $t_F$ | | | 25 | | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | | |
| Maximum Body-Diode Continuous Current | | $I_S$ | | | | 2 | A |
| Maximum Body-Diode Pulsed Current | | $I_{SM}$ | | | | 8 | A |
| Drain-Source Diode Forward Voltage | | $V_{SD}$ | $I_S$=2A, $V_{GS}$=0V | | | 1.4 | V |
| Reverse Recovery Time | | $t_{rr}$ | $V_{GS}$=0V, $I_S$ = 2A, di/dt = 100A/μs | | 140 | | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | | | 0.48 | | μC |

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

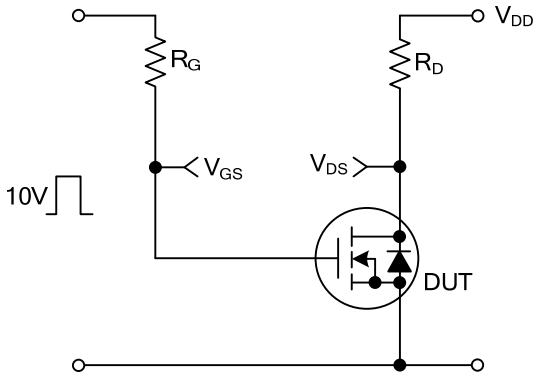
## ■ TEST CIRCUITS AND WAVEFORMS



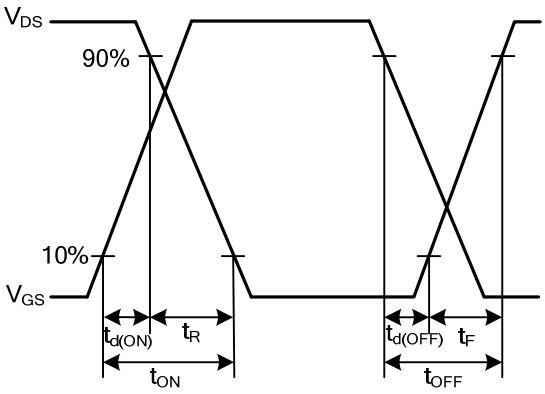

Gate Charge Test Circuit



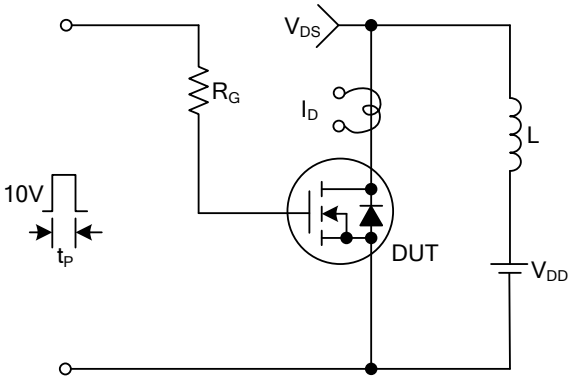

Gate Charge Waveforms



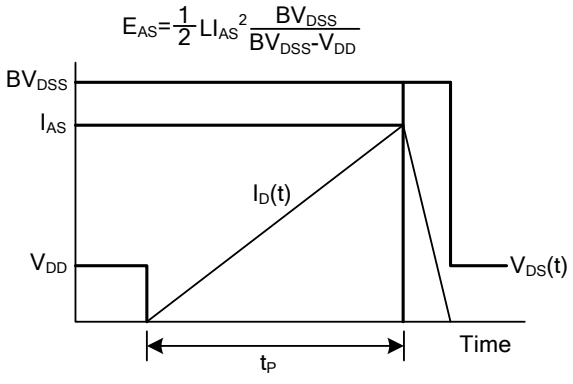

Resistive Switching Test Circuit




Resistive Switching Waveforms

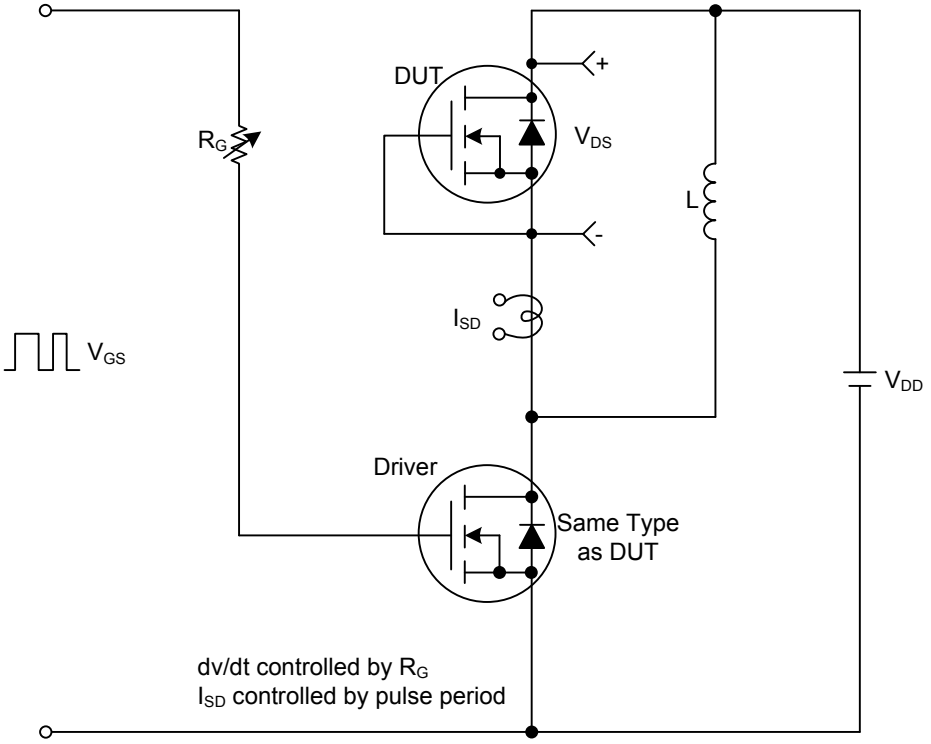



Unclamped Inductive Switching Test Circuit

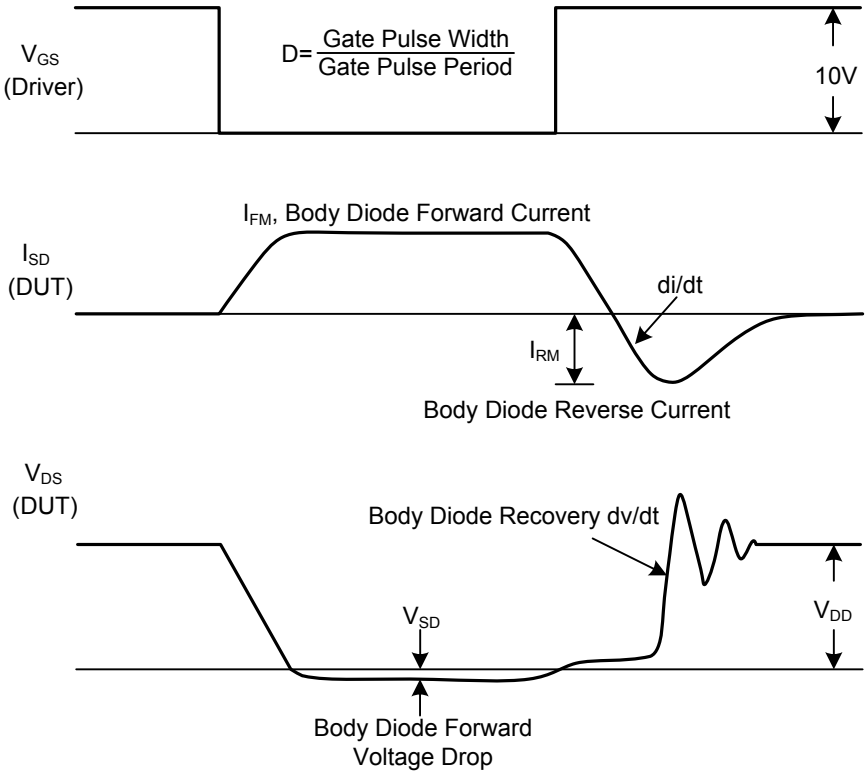



Unclamped Inductive Switching Waveforms

■ TEST CIRCUITS AND WAVEFORMS(Cont.)




Peak Diode Recovery dv/dt Test Circuit & Waveforms



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