# UNISONIC TECHNOLOGIES CO., LTD

## 2A, 800V   N-CHANNEL POWER MOSFET


TO-220    TO-220F    TO-220F1    TO-220F2    TO-251    TO-252

### ■ DESCRIPTION

The UTC **2N80Z** is an N-channel mode power MOSFET using UTC's advanced technology to provide costumers planar stripe and DMOS technology. This technology is specialized in allowing a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **2N80Z** is universally applied in high efficiency switch mode power supply.

### ■ FEATURES

* $R_{DS(on)}$ < 6.3Ω @ $V_{GS}$=10V, $I_D$=1.2A
* High switching speed

### ■ SYMBOL



2.Drain

1.Gate

3.Source
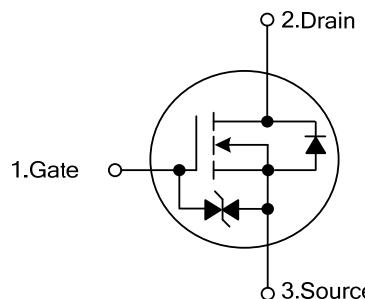
### ■ ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| 2N80ZL-TA3-T | 2N80ZG-TA3-T | TO-220 | G | D | S | Tube |
| 2N80ZL-TF3-T | 2N80ZG-TF3-T | TO-220F1 | G | D | S | Tube |
| 2N80ZL-TF1-T | 2N80ZG-TF1-T | TO-220F2 | G | D | S | Tube |
| 2N80ZL-TF2-T | 2N80ZG-TF2-T | TO-220F | G | D | S | Tube |
| 2N80ZL-TM3-R | 2N80ZG-TM3-R | TO-251 | G | D | S | Tape Reel |
| 2N80ZL-TN3-R | 2N80ZG-TN3-R | TO-252 | G | D | S | Tape Reel |

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

2N80ZL-TA3-T
- (1)Packing Type
- (2)Package Type
- (3)Green Package
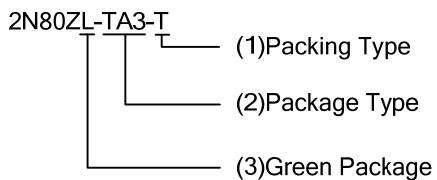
(1) R: Tape Reel, T: Tube
(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1
      TF2: TO-220F2, TM3: TO-251, TN3: TO-252
(3) L: Lead Free, G: Halogen Free and Lead Free

## ■ MARKING

```
        U T C
      2 N 8 0 Z □          ── L: Lead Free
      □ □ □ □ □          ──► G: Halogen Free
Lot Code ◄─              ──► Data Code
          1
```
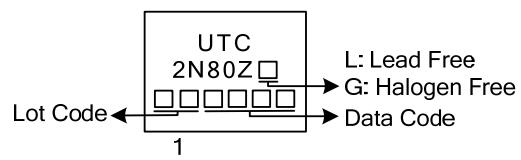
■ **ABSOLUTE MAXIMUM RATINGS** ($T_C$=25°C, unless otherwise specified)

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 800 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±20 | V |
| Avalanche Current (Note 2) | | $I_{AR}$ | 2.4 | A |
| Drain Current | Continuous | $I_D$ | 2.4 | A |
| | Pulsed (Note 2) | $I_{DM}$ | 9.6 | A |
| Avalanche Energy | Single Pulsed (Note 3) | $E_{AS}$ | 180 | mJ |
| | Repetitive (Note 2) | $E_{AR}$ | 8.5 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 4.0 | V/ns |
| Power Dissipation | TO-220 | $P_D$ | 65 | W |
| | TO-220F/TO-220F1 TO-220F2 | | 24 | W |
| | TO-251/TO-252 | | 43 | 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. L = 59mH, $I_{AS}$ = 2.4A, $V_{DD}$ = 50V, $R_G$ = 25 Ω, Starting $T_J$ = 25°C

4. $I_{SD}$ ≤ 2.4A, di/dt ≤ 200A/μs, $V_{DD}$ ≤ $BV_{DSS}$, Starting $T_J$ = 25°C

■ **THERMAL DATA**

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Junction to Ambient | TO-220/TO-220F TO-220F1/TO-220F2 | $\theta_{JA}$ | 62.5 | °C/W |
| | TO-251/TO-252 | | 110 | °C/W |
| Junction to Case | TO-220 | $\theta_{JC}$ | 1.92 | °C/W |
| | TO-220F/TO-220F1 TO-220F2 | | 5.2 | °C/W |
| | TO-251/TO-252 | | 2.85 | °C/W |

# 2N80Z

■ **ELECTRICAL CHARACTERISTICS** ($T_C$=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 | 800 | | | V |
| Breakdown Voltage Temperature Coefficient | | $\triangle BV_{DSS}/\triangle T_J$ | Reference to 25°C, $I_D$=250µA | | 0.9 | | V/°C |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$=800V, $V_{GS}$=0V | | | 10 | µA |
| | | | $V_{DS}$=640V, $T_C$=125°C | | | 100 | |
| Gate- Source Leakage Current | Forward | $I_{GSS}$ | $V_{GS}$=+20V, $V_{DS}$=0V | | | 5 | µA |
| | Reverse | | $V_{GS}$=-20V, $V_{DS}$=0V | | | -5 | µA |
| **ON CHARACTERISTICS** | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250µA | 3.0 | | 5.0 | V |
| Static Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=1.2A | | 4.8 | 6.3 | Ω |
| Forward Transconductance (Note 1) | | $g_{FS}$ | $V_{DS}$=50V, $I_D$=1.2A | | 2.65 | | S |
| **DYNAMIC PARAMETERS** | | | | | | | |
| Input Capacitance | | $C_{ISS}$ | $V_{GS}$=0V, $V_{DS}$=25V, f=1.0MHz | | 425 | 550 | pF |
| Output Capacitance | | $C_{OSS}$ | | | 45 | 60 | pF |
| Reverse Transfer Capacitance | | $C_{RSS}$ | | | 5.5 | 7.0 | pF |
| **SWITCHING PARAMETERS** | | | | | | | |
| Total Gate Charge | | $Q_G$ | $V_{GS}$=10V, $V_{DS}$=640V, $I_D$=2.4A (Note 1,2) | | 12 | 15 | nC |
| Gate to Source Charge | | $Q_{GS}$ | | | 2.6 | | nC |
| Gate to Drain Charge | | $Q_{GD}$ | | | 6.0 | | nC |
| Turn-ON Delay Time | | $t_{D(ON)}$ | $V_{DD}$=400V, $I_D$=2.4A, $R_G$=25Ω (Note 1,2) | | 12 | 35 | ns |
| Rise Time | | $t_R$ | | | 30 | 70 | ns |
| Turn-OFF Delay Time | | $t_{D(OFF)}$ | | | 25 | 60 | ns |
| Fall-Time | | $t_F$ | | | 28 | 65 | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | | |
| Maximum Continuous Drain-Source Diode Forward Current | | $I_S$ | | | | 2.4 | A |
| Maximum Pulsed Drain-Source Diode Forward Current | | $I_{SM}$ | | | | 9.6 | A |
| Drain-Source Diode Forward Voltage | | $V_{SD}$ | $I_S$=2.4A, $V_{GS}$=0V | | | 1.4 | V |
| Reverse Recovery Time (Note 1) | | $t_{RR}$ | $I_S$=2.4A, $V_{GS}$=0V, dI$_F$/dt=100A/µs | | 480 | | ns |
| Reverse Recovery Charge (Note 1) | | $Q_{RR}$ | | | 2.0 | | µC |

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 & Waveforms

$$D=\frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$
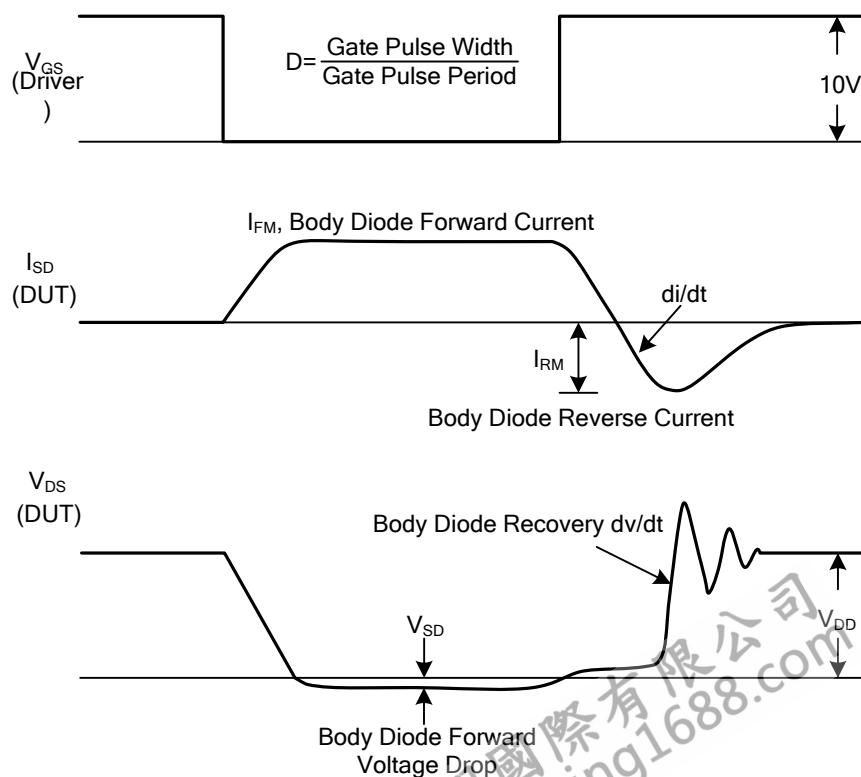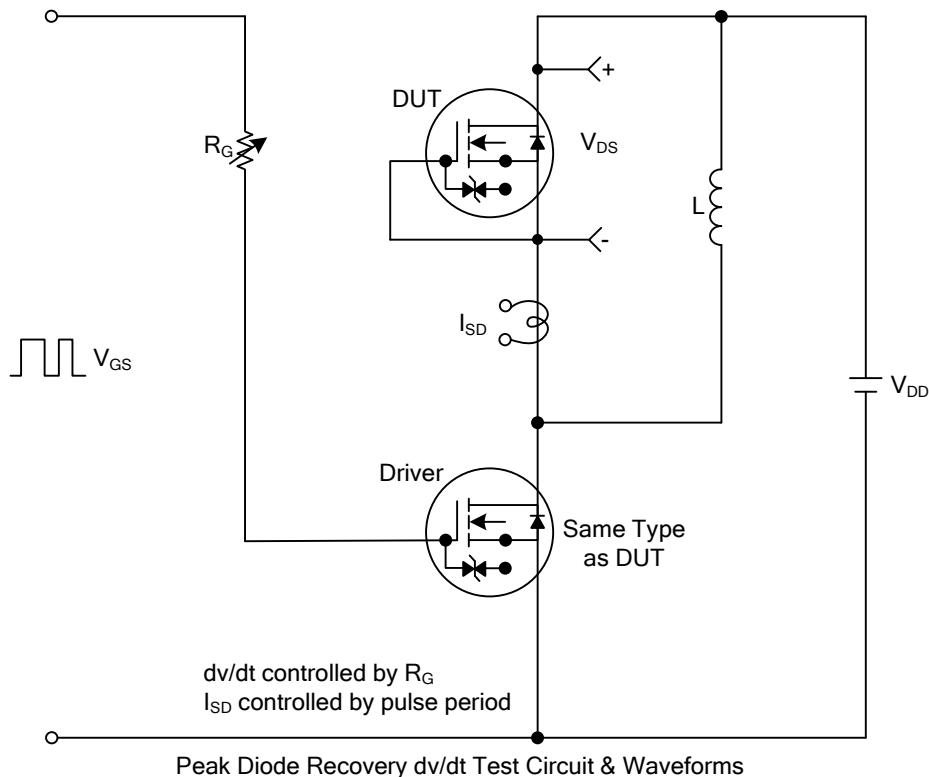
■ **TEST CIRCUITS AND WAVEFORMS(Cont.)**
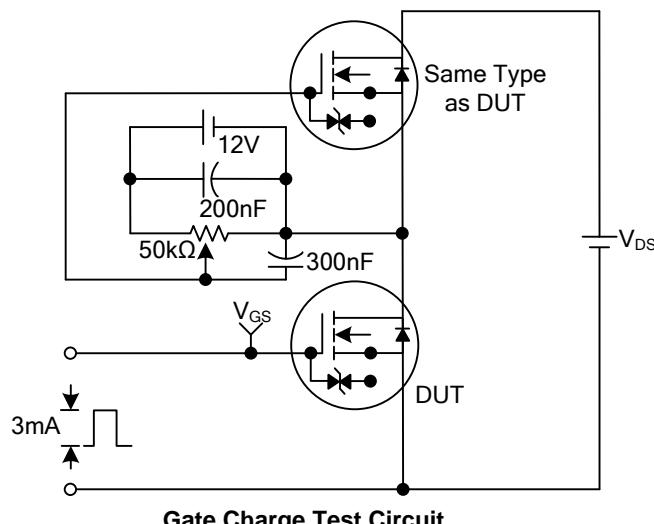


**Gate Charge Test Circuit**
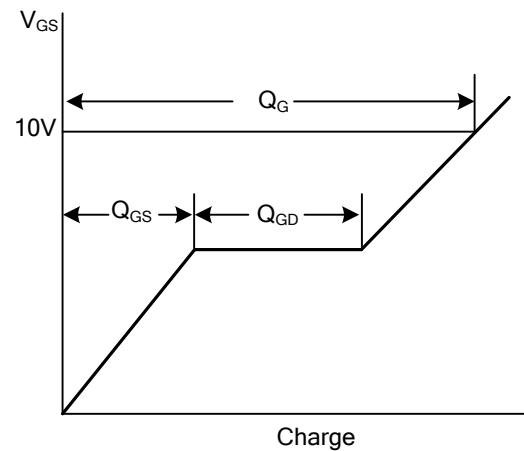


**Gate Charge Waveforms**
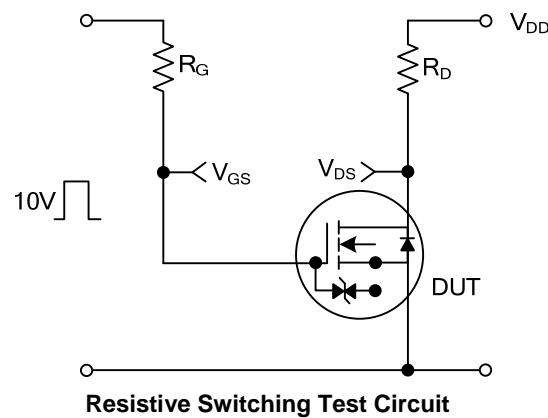


**Resistive Switching Test Circuit**
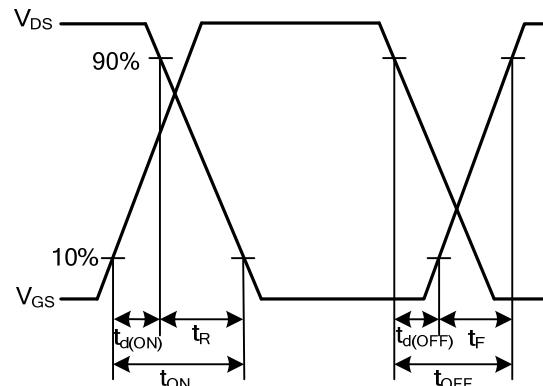


**Resistive Switching Waveforms**



**Unclamped Inductive Switching Test Circuit**

$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$
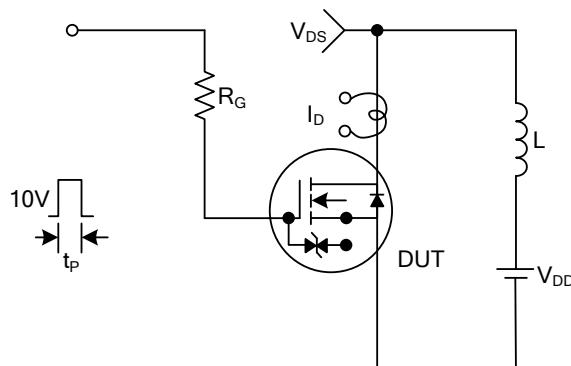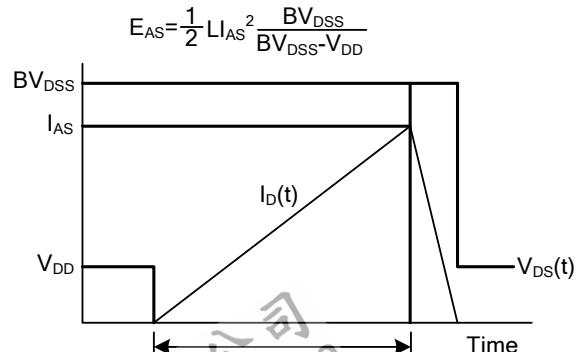


**Unclamped Inductive Switching Waveforms**

■ **TYPICAL CHARACTERISTICS**

**Drain Current vs. Drain-Source Breakdown Voltage**

X-axis: Drain-Source Breakdown Voltage, $BV_{DSS}$ (V) — 0 to 1200
Y-axis: Drain Current, $I_D$ ($\mu$A) — 0 to 300

**Drain Current vs. Gate Threshold Voltage**

X-axis: Gate Threshold Voltage, $V_{TH}$ (V) — 0 to 6
Y-axis: Drain Current, $I_D$ ($\mu$A) — 0 to 300

**Drain-Source On-State Resistance Characteristics**

$V_{GS}$=10V, $I_D$=1.2A

X-axis: Drain to Source Voltage, $V_{DS}$ (V) — 0 to 8
Y-axis: Drain Current, $I_D$ (A) — 0 to 1.4

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