



13N40

Preliminary

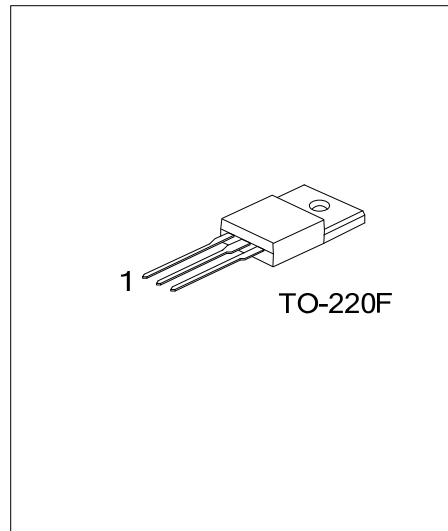
Power MOSFET

13A, 400V N-CHANNEL POWER MOSFET

DESCRIPTION

The UTC **13N40** is an N-channel mode power MOSFET using UTC's advanced technology to provide customers with planar stripe and DMOS technology. This technology specializes in allowing a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

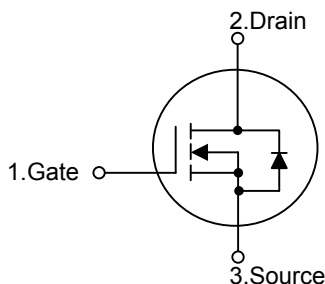
The UTC **13N40** is universally applied in electronic lamp ballast based on half bridge topology and high efficient switched mode power supply.



FEATURES

- * $R_{DS(ON)}=0.35\Omega @ V_{GS}=10V$
- * High switching speed
- * 100% avalanche tested

SYMBOL



ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|-----------------|--------------|---------|----------------|---|---|---------|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| 13N40L-TF3-T | 13N40G-TF3-T | TO-220F | G | D | S | Tube |

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

| | |
|---|--|
| <p>13N40L-TF3-T</p> <ul style="list-style-type: none"> (1) Packing Type (2) Package Type (3) Lead Free | <ul style="list-style-type: none"> (1) T: Tube (2) TF3: TO-220F (3) G: Halogen Free, L: Lead Free |
|---|--|

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

| PARAMETER | | SYMBOL | RATINGS | UNIT | |
|---------------------------|---------------------------------------|------------------------|----------|------------------|----|
| Drain-Source Voltage | | V_{DSS} | 400 | V | |
| Gate-Source Voltage | | V_{GSS} | ± 30 | V | |
| Drain Current | Continuous ($T_C=25^\circ\text{C}$) | I_D | 13 | A | |
| | Pulsed (Note 2) | I_{DM} | 52 | A | |
| Avalanche Energy | | Single Pulsed (Note 3) | E_{AS} | 705 | mJ |
| Power Dissipation | | P_D | 48 | W | |
| Junction Temperature | | T_J | +150 | $^\circ\text{C}$ | |
| Storage Temperature Range | | T_{STG} | -55~+150 | $^\circ\text{C}$ | |

Note: 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. $L = 8.34\text{mH}$, $I_{AS} = 13\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---------------------|---------------|---------|--------------------|
| Junction to Ambient | θ_{JA} | 60 | $^\circ\text{C/W}$ |
| Junction to Case | θ_{JC} | 2.58 | $^\circ\text{C/W}$ |

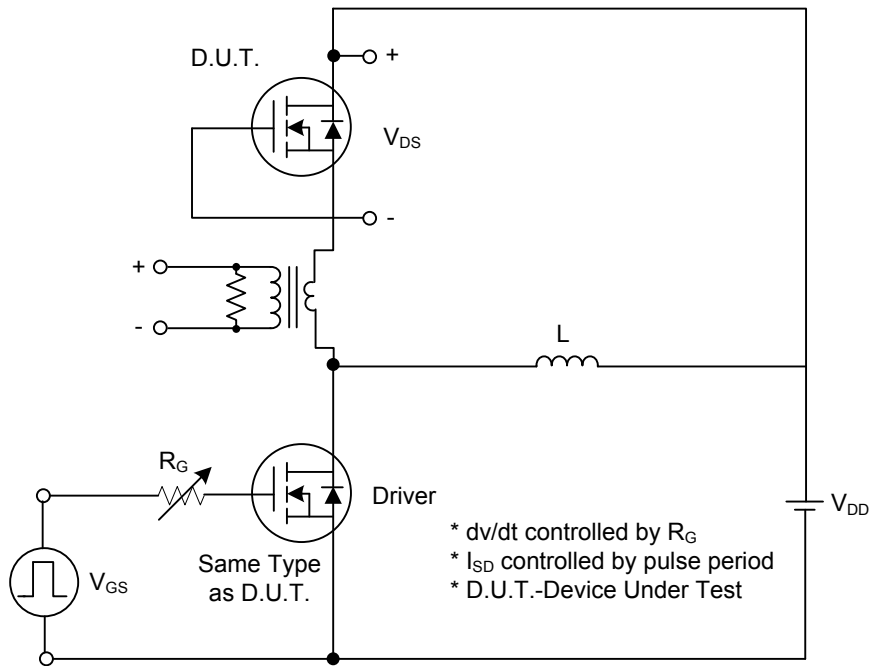
■ ELECTRICAL CHARACTERISTICS ($T_C=25^\circ\text{C}$, unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|--------------|---|-----|------|------|---------------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$ | 400 | | | V |
| Drain-Source Leakage Current | I_{DSS} | $V_{DS}=400\text{V}$, $V_{GS}=0\text{V}$ | | | 1 | μA |
| Gate- Source Leakage Current | Forward | I_{GSS} | | | +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 | $R_{DS(ON)}$ | $V_{GS}=10\text{V}$, $I_D=6.5\text{A}$ | | | 0.35 | Ω |
| DYNAMIC PARAMETERS | | | | | | |
| Input Capacitance | C_{ISS} | $V_{GS}=0\text{V}$, $V_{DS}=25\text{V}$, $f=1.0\text{MHz}$ | | 1283 | | pF |
| Output Capacitance | C_{OSS} | | | 218 | | pF |
| Reverse Transfer Capacitance | C_{RSS} | | | 120 | | pF |
| SWITCHING PARAMETERS | | | | | | |
| Turn-ON Delay Time | $t_{D(ON)}$ | $V_{DD}=200\text{V}$, $I_D=13\text{A}$, $R_G=25\Omega$ (Note 1, 2) | | 16 | | ns |
| Rise Time | t_R | | | 20 | | ns |
| Turn-OFF Delay Time | $t_{D(OFF)}$ | | | 100 | | ns |
| Fall-Time | t_F | | | 42 | | ns |
| Total Gate Charge | Q_G | $V_{DS}=320\text{V}$, $I_D=13\text{A}$, $V_{GS}=10\text{V}$ (Note 1,2) | | 79 | 100 | nC |
| Gate-Source Charge | Q_{GS} | | | 7.2 | 12 | nC |
| Gate-Drain Charge | Q_{GD} | | | 43 | 55 | nC |
| SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS | | | | | | |
| Drain-Source Diode Forward Voltage | V_{SD} | $I_S=13\text{A}$, $V_{GS}=0\text{V}$ | | | 1.2 | V |
| Maximum Body-Diode Continuous Current | I_S | | | | 13 | A |
| Maximum Body-Diode Pulsed Current | I_{SM} | | | | 52 | A |

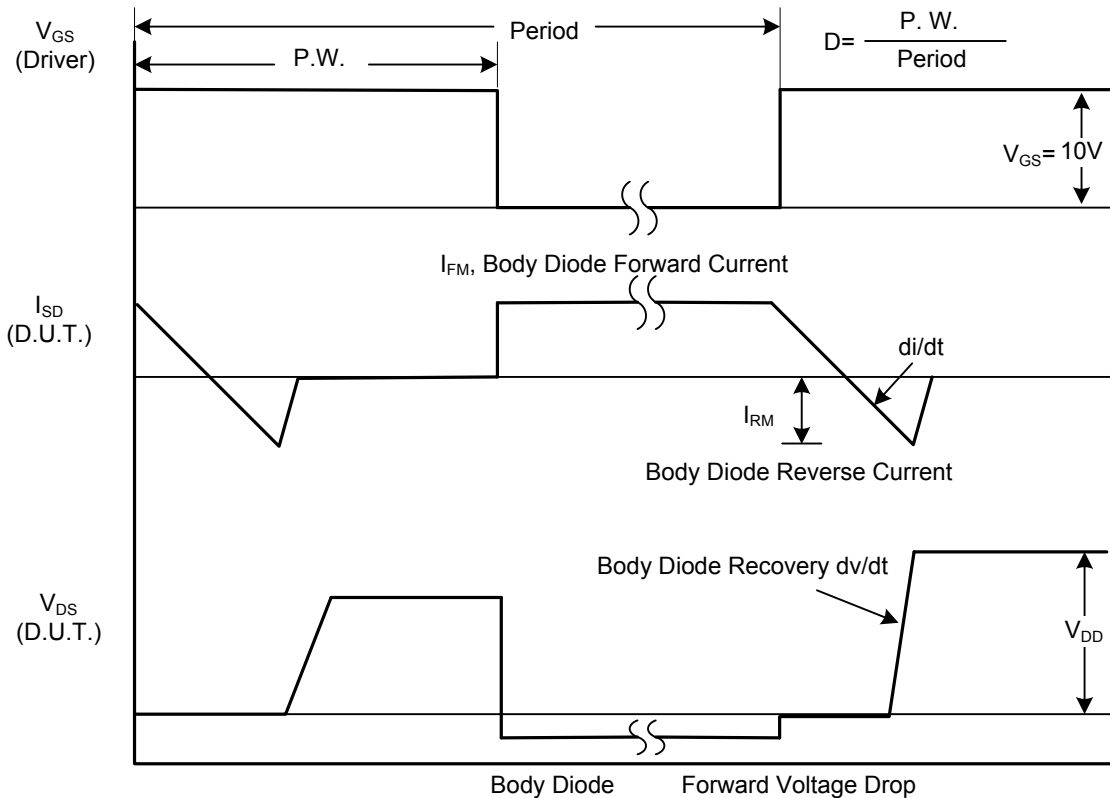
Notes: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

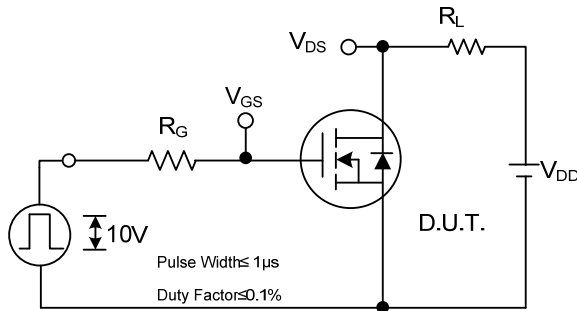


Peak Diode Recovery dv/dt Test Circuit

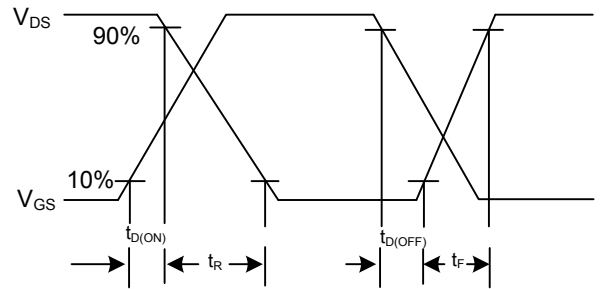


Peak Diode Recovery dv/dt Waveforms

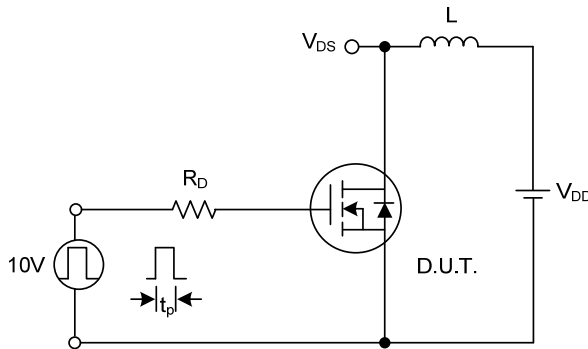
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



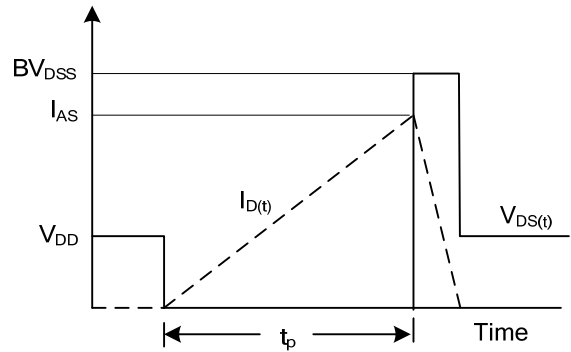
Switching Test Circuit



Switching Waveforms



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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