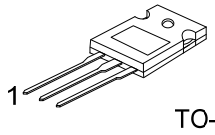
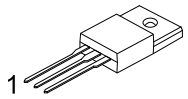
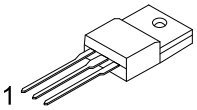
# 15A, 650V N-CHANNEL POWER MOSFET




TO-247




TO-220F




TO-220F2

## ■ DESCRIPTION

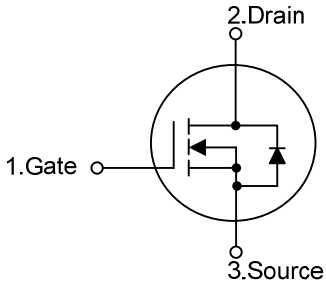
The UTC **15N65** is an N-channel mode power MOSFET using UTC's advanced technology to provide costumers with planar stripe and DMOS technology. This technology is specialized in allowing a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **15N65** is universally applied in active power factor correction and high efficient switched mode power supplies.

## ■ FEATURES

* $R_{DS(ON)}$ < 0.65Ω @ $V_{GS}$=10V, $I_D$=7.5A
* Typically 23.6pF low $C_{RSS}$
* High switching speed
* Improved dv/dt capability

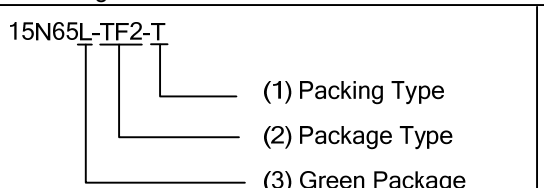
## ■ SYMBOL




## ■ ORDERING INFORMATION

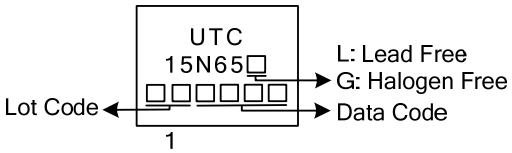
| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| 15N65L-TF2-T | 15N65G-TF2-T | TO-220F2 | G | D | S | Tube |
| 15N65L-TF3-T | 15N65G-TF3-T | TO-220F | G | D | S | Tube |
| 15N65L-T47-T | 15N65G-T47-T | TO-247 | G | D | S | Tube |

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




(1) T: Tube
(2) TF2: TO-220F2, TF3: TO-220F, T47: TO-247
(3) L: Lead Free, G: Halogen Free and Lead Free

## ■ MARKING



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

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Drain to Source Voltage | | $V_{DSS}$ | 650 | V |
| Gate to Source Voltage | | $V_{GSS}$ | ±30 | V |
| Avalanche Current (Note 2) | | $I_{AR}$ | 15 | A |
| Continuous Drain Current | Continuous | $I_D$ | 15 | A |
| | Pulsed (Note 2) | $I_{DM}$ | 60 | A |
| Avalanche Energy | Single Pulsed (Note 3) | $E_{AS}$ | 200 | mJ |
| | Repetitive (Note 2) | $E_{AR}$ | 25 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 4.5 | V/ns |
| Power Dissipation | TO-220F2 | $P_D$ | 54 | W |
| | TO-220F | | 52 | |
| | TO-247 | | 312 | |
| 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=4mH, $I_{AS}$=10A, $V_{DD}$= 50V, $R_G$=25Ω, Starting $T_J$=25°C
4. $I_{SD}$ ≤15A, di/dt ≤200A/μs, $V_{DD}$ ≤$BV_{DSS}$, Starting $T_J$=25°C.

## ■ THERMAL DATA

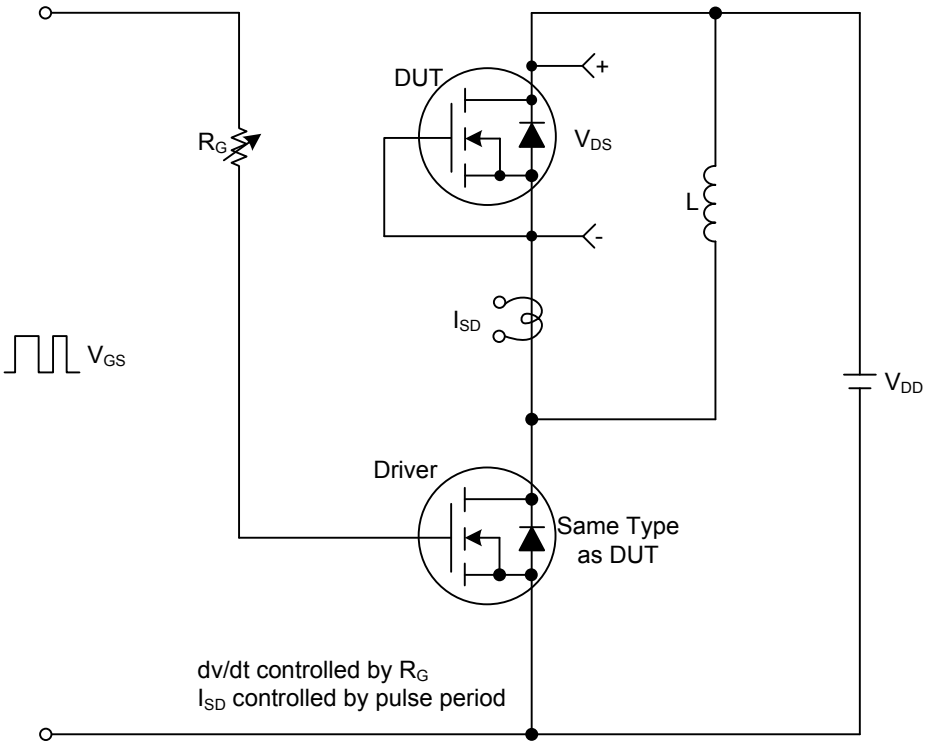
| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Junction to Ambient | TO-220F2/TO-220F | $\theta_{JA}$ | 62.5 | °C/W |
| | TO-247 | | 40 | |
| Junction to Case | TO-220F | $\theta_{JC}$ | 2.4 | °C/W |
| | TO-220F2 | | 2.3 | |
| | TO-247 | | 0.4 | |

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

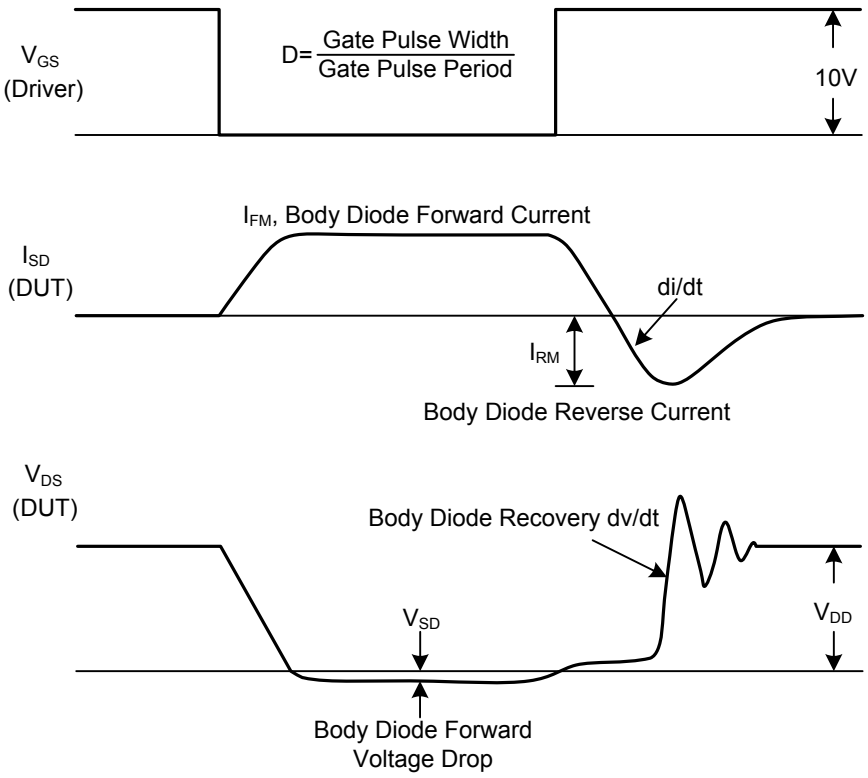
| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $V_{GS}$=0V, $I_D$=250μA, $T_J$=25°C | 650 | | | V |
| Breakdown Voltage Temperature Coefficient | | $\Delta BV_{DSS}/\Delta T_J$ | $I_D$=250μA,Referenced to 25°C | | 0.65 | | V/°C |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$=650V, $V_{GS}$=0V | | | 1 | μA |
| | | | $V_{DS}$=520V, $T_C$=125°C | | | 10 | 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 |
| Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=7.5A | | 0.5 | 0.65 | Ω |
| **DYNAMIC PARAMETERS** | | | | | | | |
| Input Capacitance | | $C_{ISS}$ | $V_{DS}$=25V,$V_{GS}$=0V,f=1.0MHz | | 2380 | 3095 | pF |
| Output Capacitance | | $C_{OSS}$ | | | 295 | 385 | pF |
| Reverse Transfer Capacitance | | $C_{RSS}$ | | | 23.6 | 35.5 | pF |
| **SWITCHING PARAMETERS** | | | | | | | |
| Total Gate Charge | | $Q_G$ | $V_{DS}$=520V, $V_{GS}$=10V, $I_D$=15A (Note 1,2) | | 48.5 | 63.0 | nC |
| Gate-Source Charge | | $Q_{GS}$ | | | 14.0 | | nC |
| Gate-Drain Charge | | $Q_{GD}$ | | | 21.2 | | nC |
| Turn-ON Delay Time | | $t_{D(ON)}$ | $V_{DD}$=325V, $I_D$=15A, $R_G$=21.7Ω (Note 1,2) | | 65 | 140 | ns |
| Turn-ON Rise Time | | $t_R$ | | | 125 | 260 | ns |
| Turn-OFF Delay Time | | $t_{D(OFF)}$ | | | 105 | 220 | ns |
| Turn-OFF Fall Time | | $t_F$ | | | 65 | 140 | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | | |
| Maximum Body-Diode Continuous Current | | $I_S$ | | | | 15 | A |
| Maximum Body-Diode Pulsed Current | | $I_{SM}$ | | | | 60 | A |
| Drain-Source Diode Forward Voltage | | $V_{SD}$ | $I_S$ =15A, $V_{GS}$=0V | | | 1.4 | V |
| Body Diode Reverse Recovery Time | | $t_{rr}$ | $V_{GS}$=0V, $I_S$=15A, $dI_F/dt$=100A/μs (Note 1) | | 496 | | ns |
| Body Diode Reverse Recovery Charge | | $Q_{RR}$ | | | 5.69 | | μC |

Notes: 1. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%.
2. Essentially independent of operating temperature.
3. Drain current limited by maximum junction temperature.

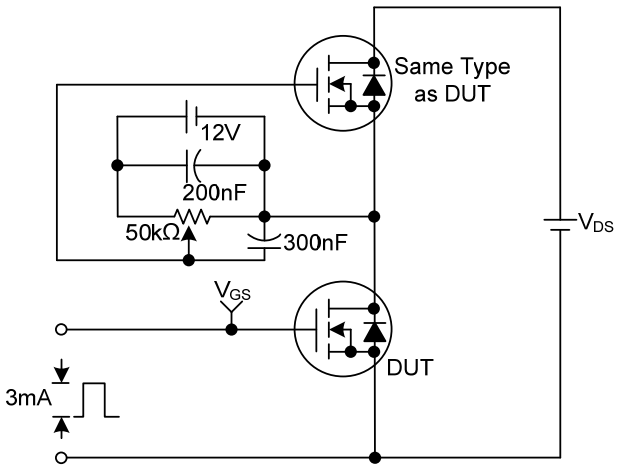
## ■ TEST CIRCUITS AND WAVEFORMS



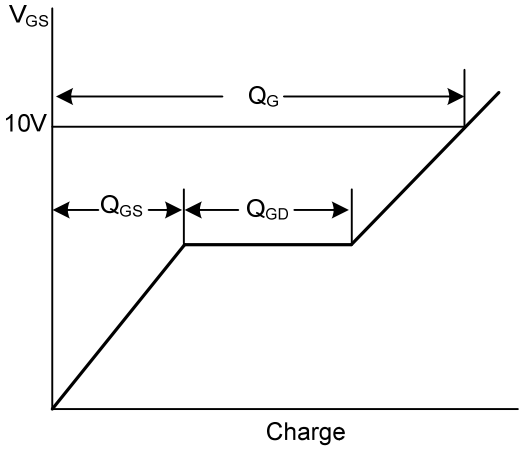

**Peak Diode Recovery dv/dt Test Circuit & Waveforms**



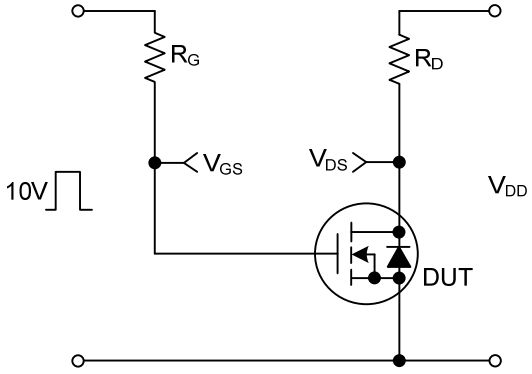
## ■ TEST CIRCUITS AND WAVEFORMS(Cont.)



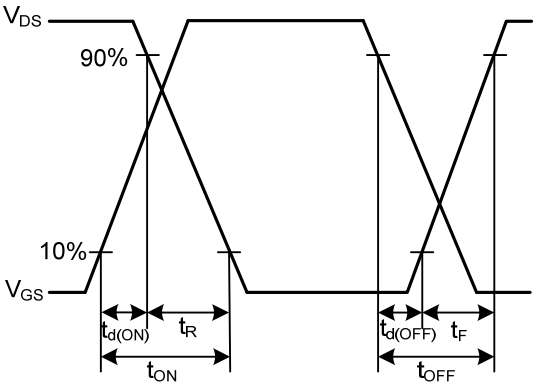

**Gate Charge Test Circuit**



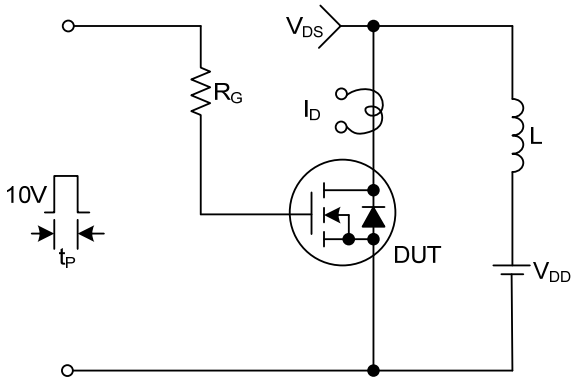

**Gate Charge Waveforms**




**Resistive Switching Test Circuit**

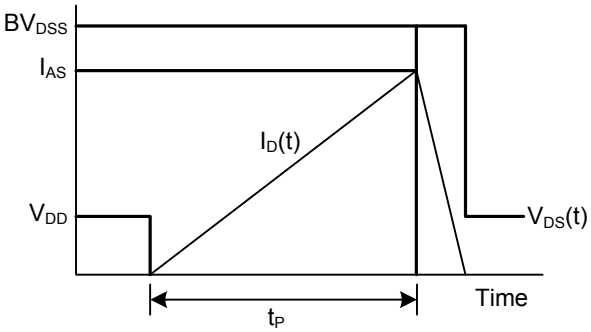



**Resistive Switching Waveforms**




**Unclamped Inductive Switching Test Circuit**

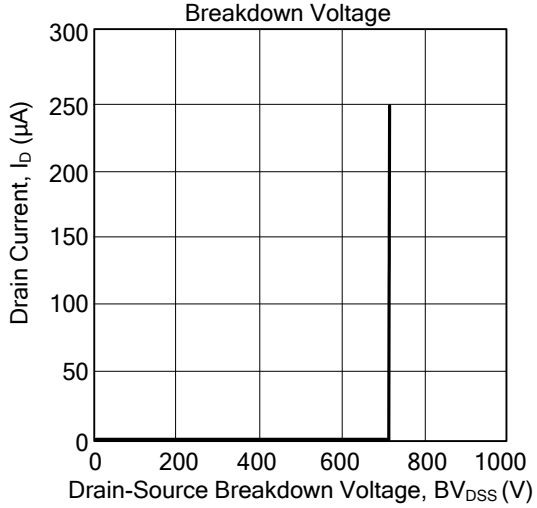
$$E_{AS}=\frac{1}{2}LI_{AS}^{2}\frac{BV_{DSS}}{BV_{DSS}-V_{DD}}$$



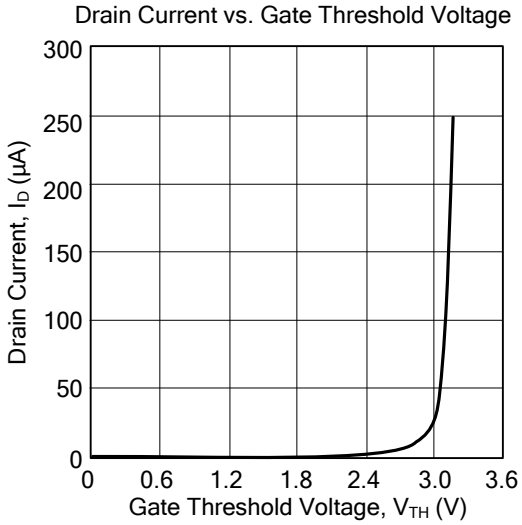

**Unclamped Inductive Switching Waveforms**

## ■ TYPICAL CHARACTERISTICS

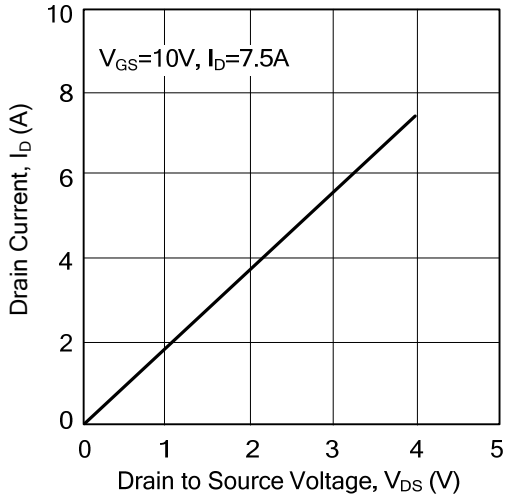
Drain Current vs. Drain-Source Breakdown Voltage




Drain Current vs. Gate Threshold Voltage




Drain-Source On-State Resistance Characteristics




Body-Diode Continuous Current vs. Source to Drain Voltage