



## 6N40K-TA

Preliminary

Power MOSFET

### 6A, 400V N-CHANNEL POWER MOSFET

#### DESCRIPTION

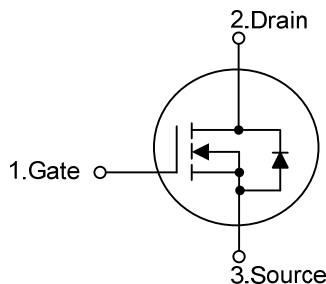
The UTC **6N40K-TA** is an N-Channel enhancement mode power MOSFET using UTC's perfect planar stripe, DMOS technology to provide customers with superior switching performance and minimum on-state resistance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **6N40K-TA** is generally used in applications, such as electronic lamp ballasts based on half bridge topology and high efficiency switched mode power supplies.

#### FEATURES

- \*  $R_{DS(ON)} < 0.6\Omega$  @  $V_{GS}=10V$ ,  $I_D=3A$
- \* Fast switching speed
- \* Improved dv/dt capability

#### SYMBOL



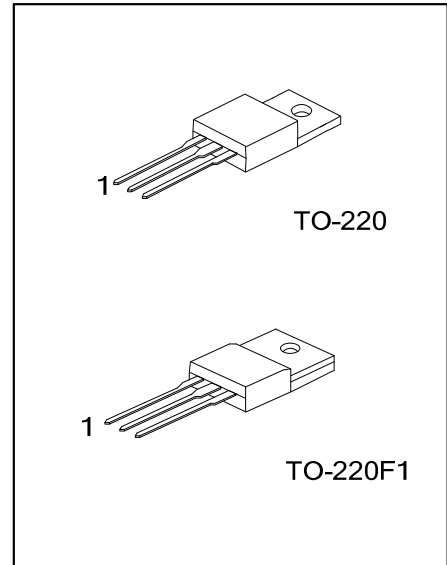
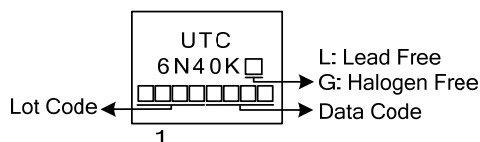
#### ORDERING INFORMATION

| Ordering Number |              | Package  | Pin Assignment |   |   | Packing |
|-----------------|--------------|----------|----------------|---|---|---------|
| Lead Free       | Halogen Free |          | 1              | 2 | 3 |         |
| 6N40KL-TA3-T    | 6N40KG-TA3-T | TO-220   | G              | D | S | Tube    |
| 6N40KL-TF1-T    | 6N40KG-TF1-T | TO-220F1 | G              | D | S | Tube    |

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

|                     |                  |                                                 |
|---------------------|------------------|-------------------------------------------------|
| <b>6N40KL-TA3-T</b> | (1)Packing Type  | (1) T: Tube                                     |
|                     | (2)Package Type  | (2) TA3: TO-220, TF1: TO-220F1                  |
|                     | (3)Green Package | (3) L: Lead Free, G: Halogen Free and Lead Free |

#### MARKING



■ 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                  |                        | $V_{GSS}$ | $\pm 30$    | V                |
| Avalanche Current (Note 2)           |                        | $I_{AR}$  | 6           | A                |
| Drain Current                        | Continuous             | $I_D$     | 6 (Note 5)  | A                |
|                                      | Pulsed (Note 2)        | $I_{DM}$  | 24 (Note 5) | A                |
| Avalanche Energy                     | Single Pulsed (Note 3) | $E_{AS}$  | 240         | mJ               |
|                                      | Repetitive (Note 2)    | $E_{AR}$  | 8.5         | mJ               |
| Peak Diode Recovery $dv/dt$ (Note 4) |                        | $dv/dt$   | 4.5         | V/ns             |
| Power Dissipation                    | TO-220                 | $P_D$     | 73          | W                |
|                                      | TO-220F1               |           | 38          |                  |
| 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.  $L=13.5\text{mH}$ ,  $I_{AS}=6\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$

4.  $I_{SD} \leq 6\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$

5. Drain current limited by maximum junction temperature

■ THERMAL DATA

| PARAMETER           |                 | SYMBOL        | RATINGS | UNIT                      |
|---------------------|-----------------|---------------|---------|---------------------------|
| Junction to Ambient | TO-220/TO-220F1 | $\theta_{JA}$ | 62.5    | $^\circ\text{C}/\text{W}$ |
| Junction to Case    | TO-220          | $\theta_{JC}$ | 1.71    | $^\circ\text{C}/\text{W}$ |
|                     | TO-220F1        |               | 3.31    |                           |

■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub>=25°C, unless otherwise specified)

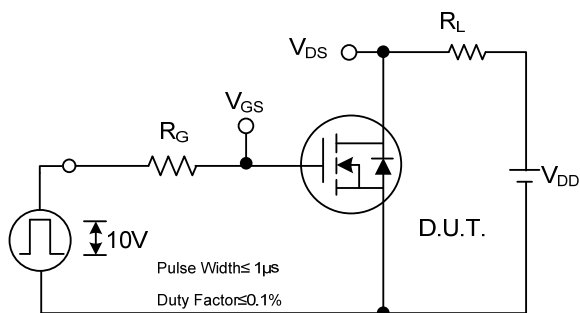
| PARAMETER                                       |         | SYMBOL                              | TEST CONDITIONS                                                                                    | MIN | TYP  | MAX  | UNIT |
|-------------------------------------------------|---------|-------------------------------------|----------------------------------------------------------------------------------------------------|-----|------|------|------|
| OFF CHARACTERISTICS                             |         |                                     |                                                                                                    |     |      |      |      |
| Drain-Source Breakdown Voltage                  |         | BV <sub>DSS</sub>                   | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                                         | 400 |      |      | V    |
| Breakdown Voltage Temperature Coefficient       |         | ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | I <sub>D</sub> =250μA,<br>Referenced to 25°C                                                       |     | 0.54 |      | V/°C |
| Drain-Source Leakage Current                    |         | I <sub>DSS</sub>                    | V <sub>DS</sub> =400V, V <sub>GS</sub> =0V                                                         |     |      | 1    | μA   |
|                                                 |         |                                     | V <sub>DS</sub> =320V, T <sub>J</sub> =125°C                                                       |     |      | 10   | μA   |
| Gate-Source Leakage Current                     | Forward | I <sub>GSS</sub>                    | V <sub>DS</sub> =0V ,V <sub>GS</sub> =+30V                                                         |     |      | +100 | nA   |
|                                                 | Reverse |                                     | V <sub>DS</sub> =0V ,V <sub>GS</sub> =-30V                                                         |     |      | -100 | nA   |
| ON CHARACTERISTICS                              |         |                                     |                                                                                                    |     |      |      |      |
| Gate Threshold Voltage                          |         | V <sub>GS(TH)</sub>                 | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                           | 2.0 |      | 4.0  | V    |
| Drain-Source On-State Resistance                |         | R <sub>DS(ON)</sub>                 | V <sub>GS</sub> =10V, I <sub>D</sub> =3A                                                           |     |      | 0.6  | Ω    |
| DYNAMIC PARAMETERS                              |         |                                     |                                                                                                    |     |      |      |      |
| Input Capacitance                               |         | C <sub>ISS</sub>                    | V <sub>DS</sub> =25V,V <sub>GS</sub> =0V,f=1.0MHz                                                  |     | 490  |      | pF   |
| Output Capacitance                              |         | C <sub>OSS</sub>                    |                                                                                                    |     | 95   |      | pF   |
| Reverse Transfer Capacitance                    |         | C <sub>RSS</sub>                    |                                                                                                    |     | 8.4  |      | pF   |
| SWITCHING PARAMETERS                            |         |                                     |                                                                                                    |     |      |      |      |
| Total Gate Charge                               |         | Q <sub>G</sub>                      | V <sub>DS</sub> =50V, V <sub>GS</sub> =10V, I <sub>D</sub> =1.3A<br>(Note 1,2)                     |     | 65   |      | nC   |
| Gate-Source Charge                              |         | Q <sub>GS</sub>                     |                                                                                                    |     | 6.2  |      | nC   |
| Gate-Drain Charge                               |         | Q <sub>GD</sub>                     |                                                                                                    |     | 8.8  |      | nC   |
| Turn-ON Delay Time                              |         | t <sub>D(ON)</sub>                  | V <sub>DD</sub> =30V, I <sub>D</sub> =0.5A, R <sub>G</sub> =25Ω<br>V <sub>GS</sub> =10V (Note 1,2) |     | 60   |      | ns   |
| Turn-ON Rise Time                               |         | t <sub>R</sub>                      |                                                                                                    |     | 65   |      | ns   |
| Turn-OFF Delay Time                             |         | t <sub>D(OFF)</sub>                 |                                                                                                    |     | 105  |      | ns   |
| Turn-OFF Fall Time                              |         | t <sub>F</sub>                      |                                                                                                    |     | 44   |      | ns   |
| SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS |         |                                     |                                                                                                    |     |      |      |      |
| Maximum Body-Diode Continuous Current           |         | I <sub>S</sub>                      |                                                                                                    |     |      | 6    | A    |
| Maximum Body-Diode Pulsed Current               |         | I <sub>SM</sub>                     |                                                                                                    |     |      | 24   | A    |
| Drain-Source Diode Forward Voltage              |         | V <sub>SD</sub>                     | I <sub>S</sub> =6A, V <sub>GS</sub> =0V                                                            |     |      | 1.4  | V    |
| Body Diode Reverse Recovery Time                |         | t <sub>rr</sub>                     | V <sub>GS</sub> =0V, I <sub>S</sub> =6A, V <sub>R</sub> =50V                                       |     | 300  |      | ns   |
| Body Diode Reverse Recovery Charge              |         | Q <sub>RR</sub>                     | dI <sub>F</sub> /dt=100A/μs (Note 1)                                                               |     | 1.75 |      | μC   |

Notes: 1. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%

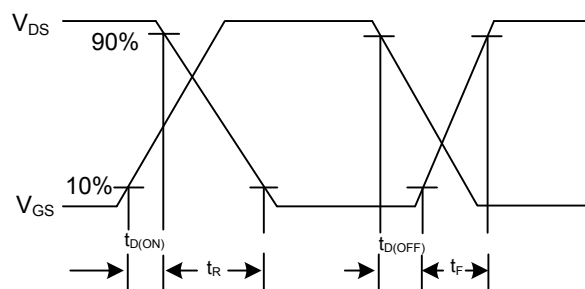
2. Essentially independent of operating temperature



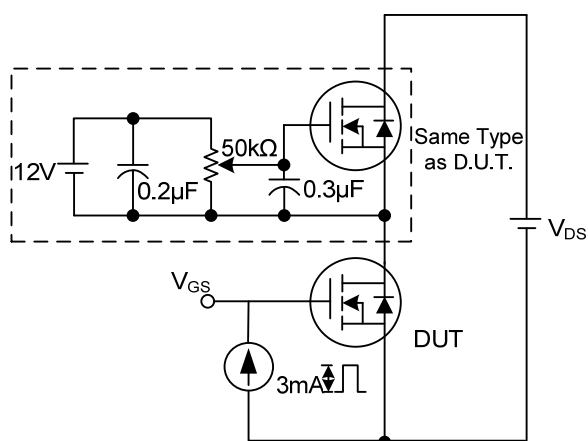
# ■ TEST CIRCUITS AND WAVEFORMS(Cont.)



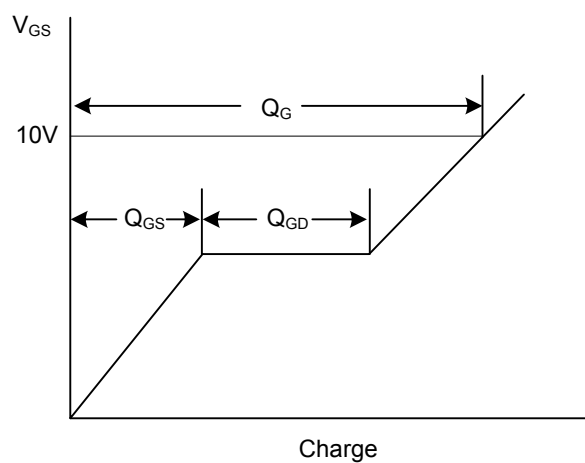
Switching Test Circuit



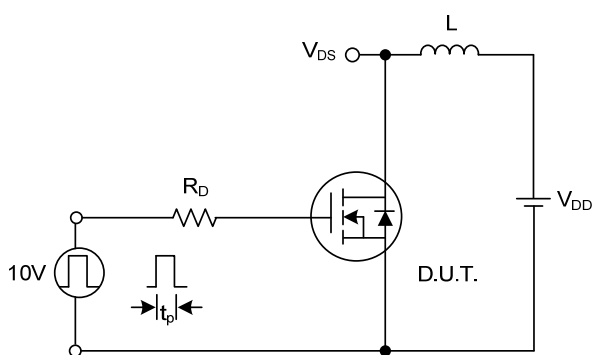
Switching Waveforms



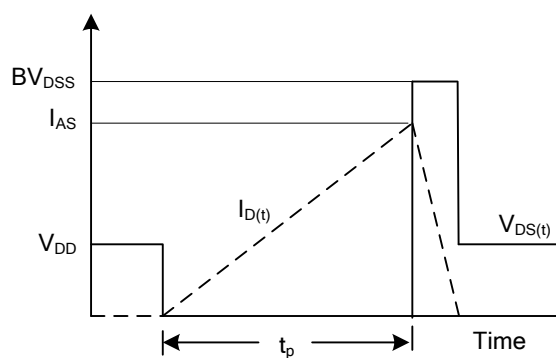
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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