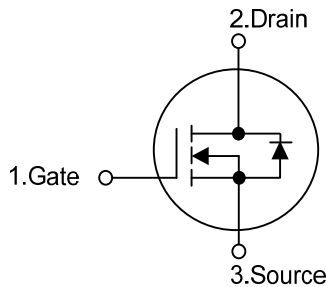


**UNA04R060M****Power MOSFET****70A, 40V N-CHANNEL  
POWER MOSFET****DESCRIPTION**

The UTC **UNA04R060M** is a N-channel enhancement mode power field effect transistors with stable off-state characteristics, fast switching speed, low thermal resistance, usually used at telecom and computer application.

**FEATURES**

- \*  $R_{DS(ON)} < 6.0\text{ m}\Omega$  @  $V_{GS} = 10\text{ V}$ ,  $I_D = 20\text{ A}$
- \*  $R_{DS(ON)} < 8.0\text{ m}\Omega$  @  $V_{GS} = 4.5\text{ V}$ ,  $I_D = 20\text{ A}$
- \* Fast switching capability
- \* Avalanche energy specified

**SYMBOL****ORDERING INFORMATION**

| Ordering Number        |                        | Package   | Pin Assignment |   |   |   |   |   |   |   | Packing   |
|------------------------|------------------------|-----------|----------------|---|---|---|---|---|---|---|-----------|
| Lead Free              | Halogen Free           |           | 1              | 2 | 3 | 4 | 5 | 6 | 7 | 8 |           |
| UNA04R060ML-TA3-R      | UNA04R060MG-TA3-R      | TO-220    | G              | D | S | - | - | - | - | - | Tube      |
| UNA04R060ML-TN3-R      | UNA04R060MG-TN3-R      | TO-252    | G              | D | S | - | - | - | - | - | Tape Reel |
| UNA04R060ML-TND-R      | UNA04R060MG-TND-R      | TO-252D   | G              | D | S | - | - | - | - | - | Tape Reel |
| UNA04R060MG-K08-5060-R | UNA04R060MG-K08-5060-R | DFN5060-8 | S              | S | S | G | D | D | D | D | Tape Reel |

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

|                              |  |                                                                                                                                                    |
|------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>UNA04R060MG-TA3-R</b><br> |  | (1) T: Tube, R: Tape Reel<br>(2) TA3: TO-220, TN3: TO-252, TND: TO-252D,<br>K08-5060: DFN5060-8<br>(3) G: Halogen Free and Lead Free, L: Lead Free |
|------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------|

MARKING

| TO-220 / TO-252 / TO-252D                                                                                                                         | DFN5060-8                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <div><div>UTC   UNA<br/>04R060M□<br/>□□□□□□</div><div>Lot Code ←   → Date Code</div><div>L: Lead Free<br/>G: Halogen Free</div><div>1</div></div> | <div><div>UTC   UNA<br/>04R060M<br/>• □□□□□□</div><div>Lot Code ←   → Date Code</div></div> |

### ■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER                          |                        |           | SYMBOL           | RATINGS    | UNIT |
|------------------------------------|------------------------|-----------|------------------|------------|------|
| Drain-Source Voltage               |                        |           | V <sub>DSS</sub> | 40         | V    |
| Gate-Source Voltage                |                        |           | V <sub>GSS</sub> | ±20        | V    |
| Continuous Drain Current           | T <sub>C</sub> = 25°C  | TO-220    | I <sub>D</sub>   | 70         | A    |
|                                    |                        | TO-252    |                  |            |      |
|                                    | TO-252D                |           |                  |            |      |
|                                    | DFN5060-8              | 50        |                  | A          |      |
|                                    | T <sub>C</sub> = 100°C | TO-220    |                  | 42         | A    |
|                                    |                        | TO-252    |                  |            |      |
|                                    |                        | TO-252D   |                  |            |      |
|                                    |                        | DFN5060-8 |                  | 30         | A    |
| Drain Current Pulsed (Note 2)      |                        | TO-220    | I <sub>DM</sub>  | 210        | A    |
|                                    |                        | TO-252    |                  |            |      |
|                                    |                        | TO-252D   |                  |            |      |
|                                    |                        | DFN5060-8 |                  | 150        | A    |
| Avalanche Energy                   | Single Pulsed (Note 3) |           | E <sub>AS</sub>  | 80         | mJ   |
| Peak Diode Recovery dv/dt (Note 4) |                        |           | dv/dt            | 10         | V/ns |
| Power Dissipation                  |                        | TO-220    | P <sub>D</sub>   | 110        | W    |
|                                    |                        | TO-252    |                  |            |      |
|                                    |                        | TO-252D   |                  | 50         | W    |
|                                    |                        | DFN5060-8 |                  | 31         | W    |
| Junction Temperature               |                        |           | T <sub>J</sub>   | +150       | °C   |
| Storage Temperature                |                        |           | T <sub>STG</sub> | -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. Repeativity rating: pulse width limited by junction temperature.

3.  $L=0.1\text{mH}$ ,  $I_{AS}=40\text{A}$ ,  $V_{DD}=25\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$

4.  $I_{SD}\leq 48\text{A}$ ,  $di/dt\leq 300\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DS}$ , Starting  $T_J=25^\circ\text{C}$

### ■ THERMAL DATA (Note)

| PARAMETER           |           | SYMBOL        | RATINGS | UNIT                      |
|---------------------|-----------|---------------|---------|---------------------------|
| Junction to Ambient | TO-220    | $\theta_{JA}$ | 62.5    | $^\circ\text{C}/\text{W}$ |
|                     | TO-252    |               |         |                           |
|                     | TO-252D   |               | 110     | $^\circ\text{C}/\text{W}$ |
|                     | DFN5060-8 |               | 35      | $^\circ\text{C}/\text{W}$ |
| Junction to Case    | TO-220    | $\theta_{JC}$ | 1.14    | $^\circ\text{C}/\text{W}$ |
|                     | TO-252    |               |         |                           |
|                     | TO-252D   |               | 2.5     | $^\circ\text{C}/\text{W}$ |
|                     | DFN5060-8 |               | 4.1     | $^\circ\text{C}/\text{W}$ |

Note: The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.

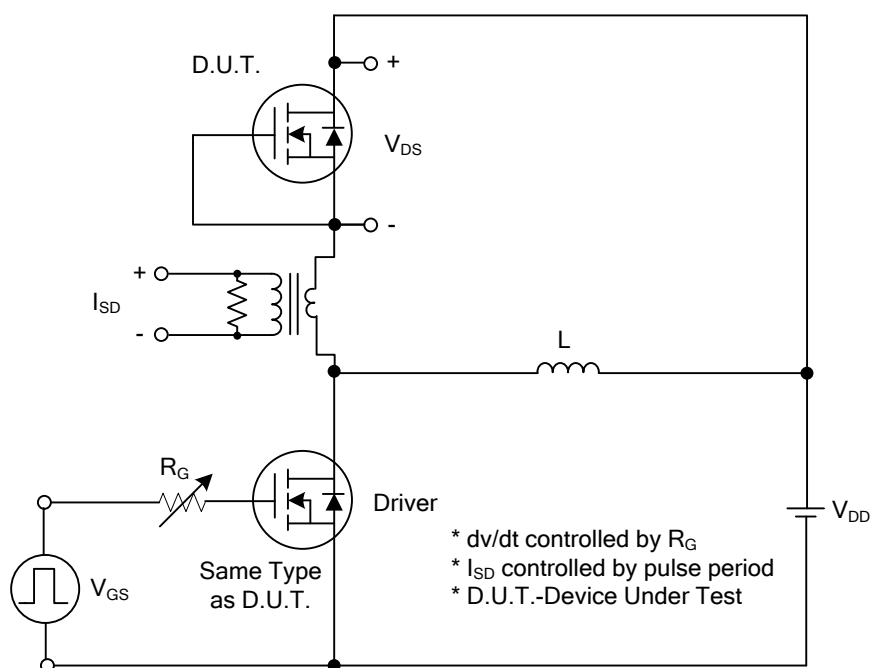
### ■ ELECTRICAL CHARACTERISTICS (T<sub>c</sub> = 25°C, unless otherwise specified)

| 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                                                          | 40  |      |      | V    |
| Drain-Source Leakage Current                           |         | I <sub>DSS</sub>    | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V                                                           |     |      | 1    | μA   |
| Gate-Source Leakage Current                            | Forward | I <sub>GSS</sub>    | V <sub>GS</sub> =20V, V <sub>DS</sub> =0V                                                           |     |      | 100  | nA   |
|                                                        | Reverse |                     | V <sub>GS</sub> =-20V, V <sub>DS</sub> =0V                                                          |     |      | -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                                            | 1.0 | 1.6  | 3.0  | V    |
| Static Drain-Source On-State Resistance                |         | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                                                           |     |      | 6.0  | mΩ   |
|                                                        |         |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A                                                          |     |      | 8.0  | mΩ   |
| DYNAMIC CHARACTERISTICS                                |         |                     |                                                                                                     |     |      |      |      |
| Input Capacitance                                      |         | C <sub>ISS</sub>    | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz                                                   |     | 5509 |      | pF   |
| Output Capacitance                                     |         | C <sub>OSS</sub>    |                                                                                                     |     | 440  |      | pF   |
| Reverse Transfer Capacitance                           |         | C <sub>RSS</sub>    |                                                                                                     |     | 280  |      | pF   |
| SWITCHING CHARACTERISTICS                              |         |                     |                                                                                                     |     |      |      |      |
| Total Gate Charge                                      |         | Q <sub>G</sub>      | V <sub>DS</sub> =30V, V <sub>GS</sub> =10V, I <sub>D</sub> =1.3A, I <sub>D</sub> =100μA (Note 1, 2) |     | 189  |      | nC   |
| Gate-Source Charge                                     |         | Q <sub>GS</sub>     |                                                                                                     |     | 10   |      | nC   |
| Gate-Drain Charge (Miller Charge)                      |         | Q <sub>GD</sub>     |                                                                                                     |     | 12.8 |      | nC   |
| Turn-On Delay Time                                     |         | t <sub>D(ON)</sub>  | V <sub>DD</sub> =20V, V <sub>GS</sub> =10V, I <sub>D</sub> =0.5A (Note 1, 2)                        |     | 100  |      | ns   |
| Turn-On Rise Time                                      |         | t <sub>R</sub>      |                                                                                                     |     | 133  |      | ns   |
| Turn-Off Delay Time                                    |         | t <sub>D(OFF)</sub> |                                                                                                     |     | 780  |      | ns   |
| Turn-Off Fall Time                                     |         | t <sub>F</sub>      |                                                                                                     |     | 300  |      | ns   |
| DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS |         |                     |                                                                                                     |     |      |      |      |
| Maximum Continuous Drain-Source Diode Forward Current  |         | I <sub>S</sub>      |                                                                                                     |     |      | 70   | A    |
| Maximum Pulsed Drain-Source Diode Forward Current      |         | I <sub>SM</sub>     |                                                                                                     |     |      | 210  | A    |
| Drain-Source Diode Forward Voltage                     |         | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =20A                                                            |     |      | 1.0  | V    |
| Reverse Recovery Time                                  |         | t <sub>rr</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =20A                                                            |     | 2.67 |      | ns   |
| Reverse Recovery Charge                                |         | Q <sub>rr</sub>     | dI <sub>F</sub> /dt=100A/μs                                                                         |     | 0.16 |      | μC   |

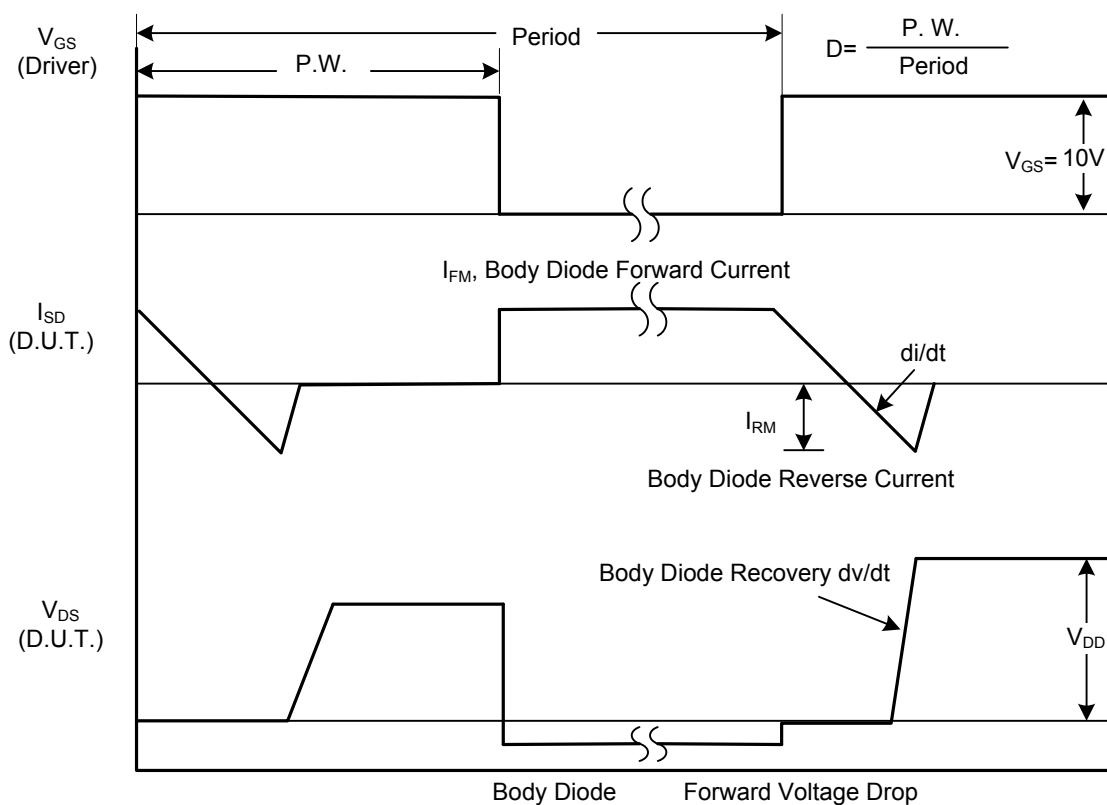
Notes: 1. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%

2. Essentially independent of operating temperature.

## ■ TEST CIRCUITS AND WAVEFORMS



1A Peak Diode Recovery dv/dt Test Circuit



1B Peak Diode Recovery dv/dt Waveforms

## ■ TEST CIRCUITS AND WAVEFORMS (Cont.)

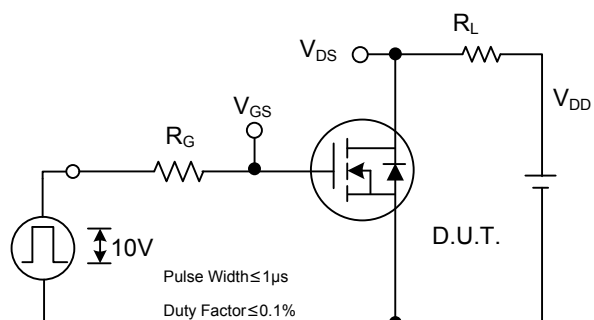


Fig. 2A Switching Test Circuit

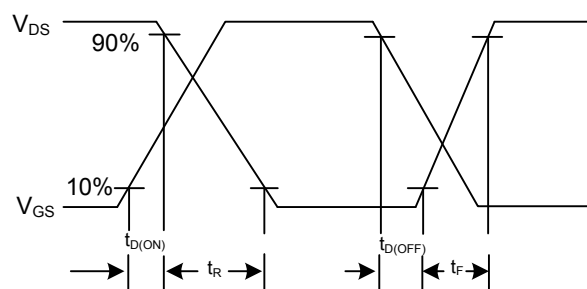


Fig. 2B Switching Waveforms

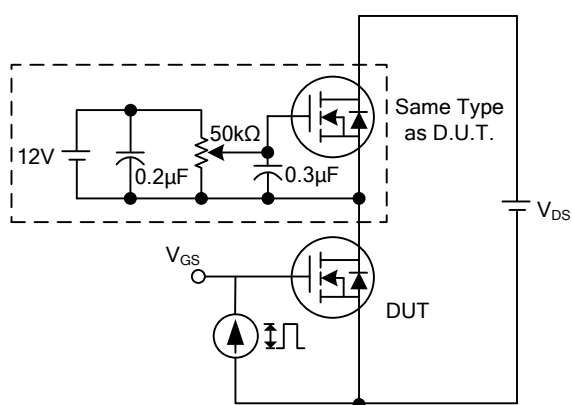


Fig. 3A Gate Charge Test Circuit

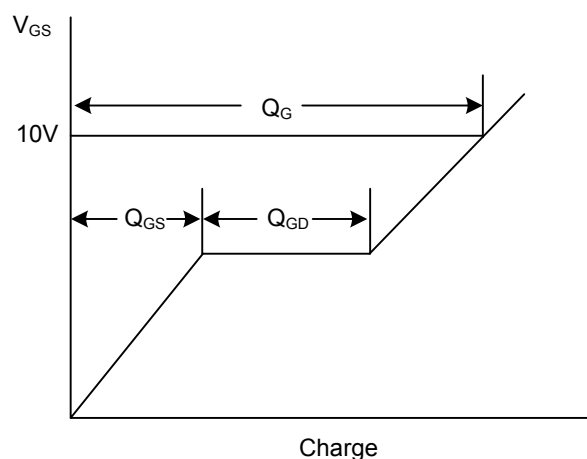


Fig. 3B Gate Charge Waveform

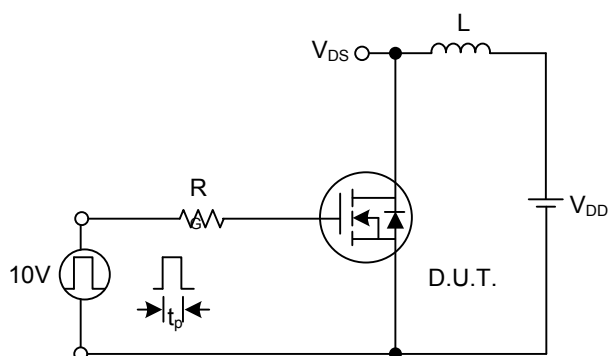


Fig. 4A Unclamped Inductive Switching Test Circuit

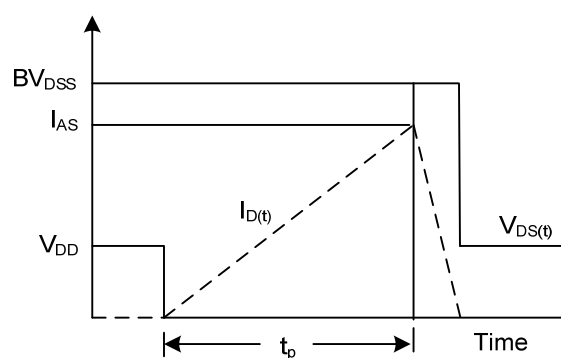


Fig. 4B Unclamped Inductive Switching Waveforms

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