

**UT50N04****Power MOSFET****50A, 40V N-CHANNEL  
POWER MOSFET****DESCRIPTION**

The UTC **UT50N04** is a N-channel enhancement MOSFET using UTC's advanced technology to provide the customers with perfect  $R_{DS(ON)}$  and high switching speed.

**FEATURES****TO-220/TO-252/TO-263**

\*  $R_{DS(ON)} \leq 7.0 \text{ m}\Omega$  @  $V_{GS}=10\text{V}$ ,  $I_D=25\text{A}$

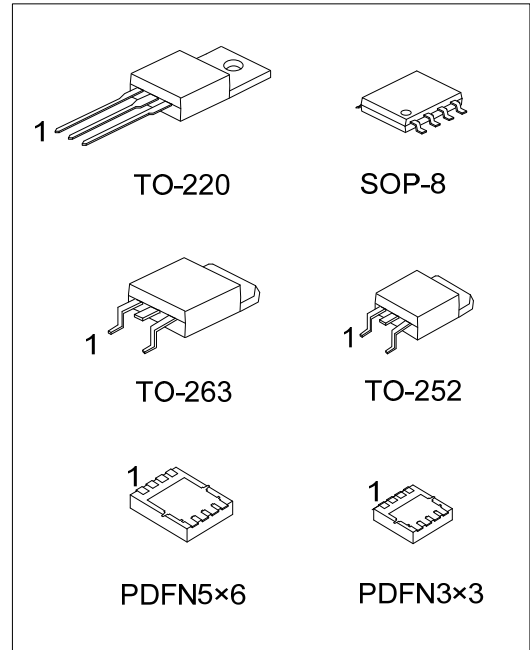
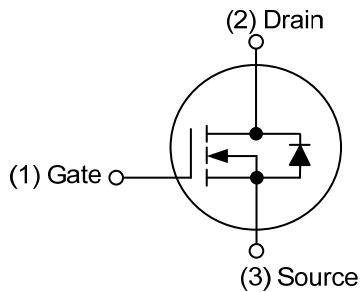
\*  $R_{DS(ON)} \leq 10 \text{ m}\Omega$  @  $V_{GS}=4.5\text{V}$ ,  $I_D=20\text{A}$

**PDFN3x3/PDFN5x6/SOP-8**

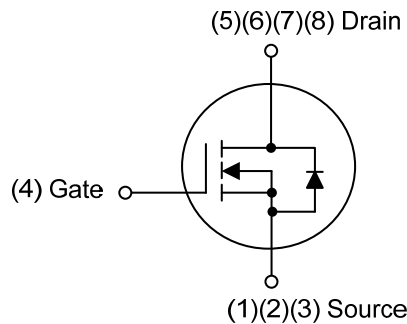
\*  $R_{DS(ON)} \leq 6.5 \text{ m}\Omega$  @  $V_{GS}=10 \text{ V}$ ,  $I_D=25\text{A}$

\*  $R_{DS(ON)} \leq 8.0 \text{ m}\Omega$  @  $V_{GS}=4.5\text{V}$ ,  $I_D=25\text{A}$

\* High Switching Speed

**SYMBOL**

TO-220 / TO-252 / TO-263

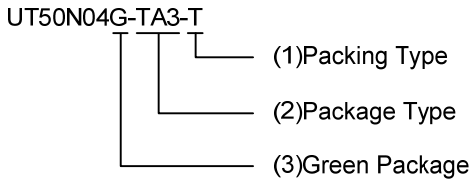


SOP-8/PDFN3x3/PDFN5x6

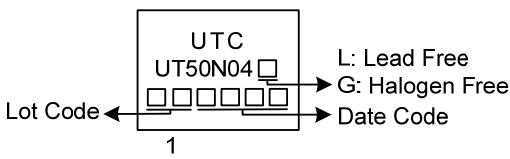
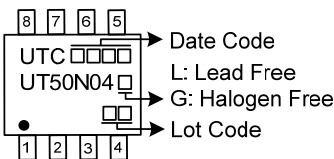
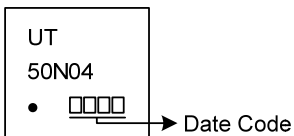
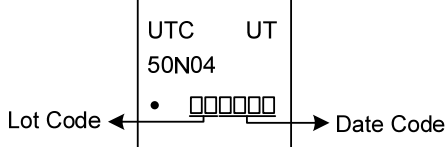
### ORDERING INFORMATION

| Ordering Number  |                  | Package | Pin Assignment |   |   |   |   |   |   |   | Packing   |
|------------------|------------------|---------|----------------|---|---|---|---|---|---|---|-----------|
| Lead Free        | Halogen Free     |         | 1              | 2 | 3 | 4 | 5 | 6 | 7 | 8 |           |
| UT50N04L-TA3-T   | UT50N04G-TA3-T   | TO-220  | G              | D | S | - | - | - | - | - | Tube      |
| UT50N04L-TN3-R   | UT50N04G-TN3-R   | TO-252  | G              | D | S | - | - | - | - | - | Tape Reel |
| UT50N04L-TQ2-T   | UT50N04G-TQ2-T   | TO-263  | G              | D | S | - | - | - | - | - | Tube      |
| UT50N04L-TQ2-R   | UT50N04G-TQ2-R   | TO-263  | G              | D | S | - | - | - | - | - | Tape Reel |
| UT50N04L-S08-R   | UT50N04G-S08-R   | SOP-8   | S              | S | S | G | D | D | D | D | Tape Reel |
| UT50N04L-P3030-R | UT50N04G-P3030-R | PDFN3×3 | S              | S | S | G | D | D | D | D | Tape Reel |
| UT50N04L-P5060-R | UT50N04G-P5060-R | PDFN5×6 | S              | S | S | G | D | D | D | D | Tape Reel |

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

|                                                                                                                                                                            |                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>UT50N04G-TA3-T</p>  <p>(1) Packing Type<br/>(2) Package Type<br/>(3) Green Package</p> | <p>(1) T: Tube, R: Tape Reel<br/>(2) TA3: TO-220, TN3: TO-252, TQ2: TO-263<br/>S08: SOP-8, P3030: PDFN3×3, P5060: PDFN5×6<br/>(3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### MARKING

| TO-220 / TO-252 / TO-263                                                                                                                                                  | SOP-8                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>UTC<br/>UT50N04<br/>L: Lead Free<br/>G: Halogen Free<br/>Date Code<br/>Lot Code</p> |  <p>UTC<br/>UT50N04<br/>L: Lead Free<br/>G: Halogen Free<br/>Date Code<br/>Lot Code</p> |
| PDFN3×3                                                                                                                                                                   | PDFN5×6                                                                                                                                                                    |
|  <p>UT<br/>50N04<br/>Date Code</p>                                                     |  <p>UTC UT<br/>50N04<br/>Date Code<br/>Lot Code</p>                                    |

### ■ 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    |
| Drain Current                      | Continuous<br>(V <sub>GS</sub> =10V) | Other | I <sub>D</sub>   | 50         | A    |
|                                    |                                      | SOP-8 |                  | 20         | A    |
|                                    | Pulsed<br>(Note 2)                   | Other | I <sub>DM</sub>  | 100        | A    |
|                                    |                                      | SOP-8 |                  | 50         | A    |
| Avalanche Energy                   | Single Pulsed (Note 3)               |       | E <sub>AS</sub>  | 93         | mJ   |
| Peak Diode Recovery dv/dt (Note 4) |                                      |       | dv/dt            | 0.79       | V/ns |
| Power Dissipation                  | TO-220/TO-263                        |       | P <sub>D</sub>   | 160        | W    |
|                                    | TO-252                               |       |                  | 52         | W    |
|                                    | SOP-8                                |       |                  | 5.2        | W    |
|                                    | PDFN3×3                              |       |                  | 32         | W    |
|                                    | PDFN5×6                              |       |                  | 41         | W    |
| Junction Temperature               |                                      |       | T <sub>J</sub>   | +150       | °C   |
| Storage Temperature                |                                      |       | T <sub>STG</sub> | -55 ~ +175 | °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.  $L = 0.1mH$ ,  $I_{AS} = 43.13A$ ,  $V_{DD} = 25V$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$ .

4.  $I_{SD} \leq 30A$ ,  $di/dt \leq 200A/\mu s$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ C$ .

### ■ THERMAL DATA

| PARAMETER           |               | SYMBOL        | RATINGS     | UNIT |
|---------------------|---------------|---------------|-------------|------|
| Junction to Ambient | TO-220/TO-263 | $\theta_{JA}$ | 62.5        | °C/W |
|                     | TO-252        |               | 110         | °C/W |
|                     | SOP-8         |               | 125 (Note)  | °C/W |
|                     | PDFN3×3       |               | 75 (Note)   | °C/W |
|                     | PDFN5×6       |               | 65 (Note)   | °C/W |
| Junction to Case    | TO-220/TO-263 | $\theta_{JC}$ | 0.78        | °C/W |
|                     | TO-252        |               | 2.4 (Note)  | °C/W |
|                     | SOP-8         |               | 24 (Note)   | °C/W |
|                     | PDFN3×3       |               | 3.9 (Note)  | °C/W |
|                     | PDFN5×6       |               | 3.04 (Note) | °C/W |

Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

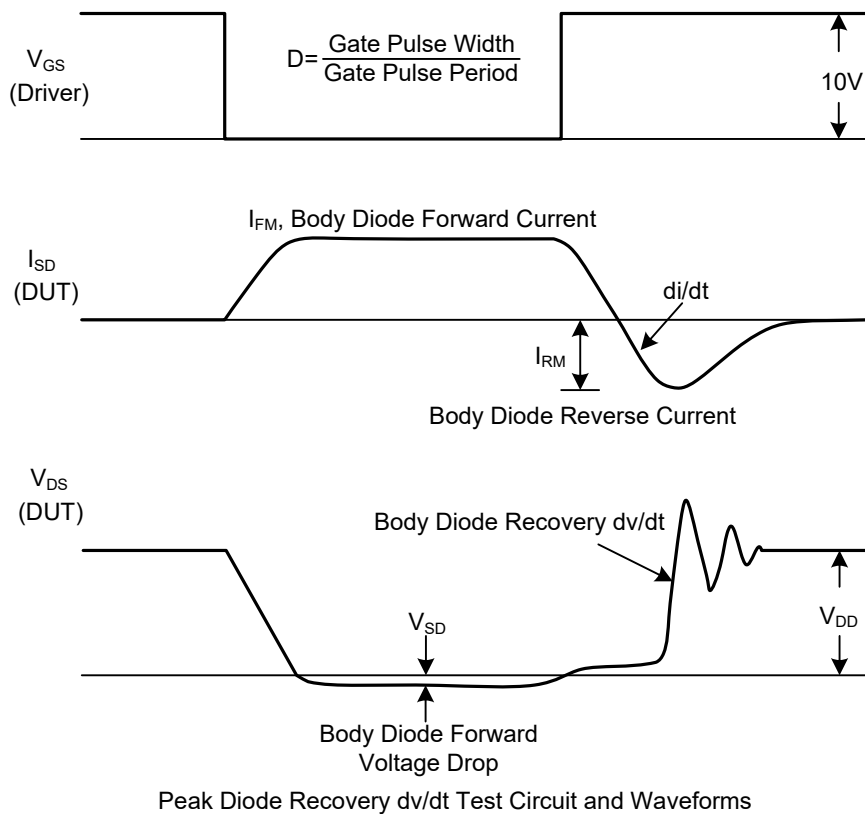
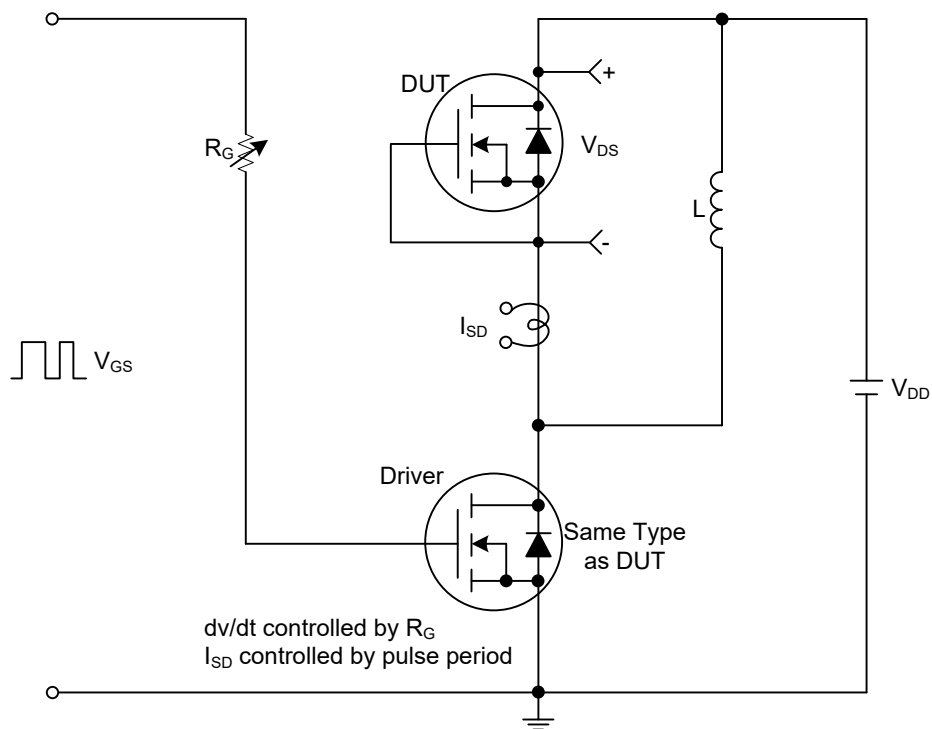
### ■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

| 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 |      | 3.0  | V    |
| Static Drain-Source On-State Resistance               | TO-220           | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =25A                                                            |     |      | 7.0  | mΩ   |
|                                                       | TO-252           |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =25A                                                           |     |      | 10   | mΩ   |
|                                                       | TO-263           |                     | V <sub>GS</sub> =10V, I <sub>D</sub> =25A                                                            |     |      | 6.5  | mΩ   |
|                                                       | PDFN3×3          |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =25A                                                           |     |      | 8.0  | mΩ   |
|                                                       | PDFN5×6<br>SOP-8 |                     |                                                                                                      |     |      |      |      |
| DYNAMIC PARAMETERS                                    |                  |                     |                                                                                                      |     |      |      |      |
| Input Capacitance                                     |                  | C <sub>ISS</sub>    | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1.0MHz                                                  |     | 2718 |      | pF   |
| Output Capacitance                                    |                  | C <sub>OSS</sub>    |                                                                                                      |     | 260  |      | pF   |
| Reverse Transfer Capacitance                          |                  | C <sub>RSS</sub>    |                                                                                                      |     | 234  |      | pF   |
| SWITCHING PARAMETERS                                  |                  |                     |                                                                                                      |     |      |      |      |
| Total Gate Charge                                     |                  | Q <sub>G</sub>      | V <sub>DS</sub> =32V, V <sub>GS</sub> =10V, I <sub>D</sub> =50A<br>(Note 1, 2)                       |     | 91.4 |      | nC   |
| Gate to Source Charge                                 |                  | Q <sub>GS</sub>     |                                                                                                      |     | 7.6  |      | nC   |
| Gate to Drain Charge                                  |                  | Q <sub>GD</sub>     |                                                                                                      |     | 38   |      | nC   |
| Turn-ON Delay Time                                    |                  | t <sub>D(ON)</sub>  | V <sub>DD</sub> =20V, V <sub>GS</sub> =10V, I <sub>D</sub> =50A,<br>R <sub>G</sub> =3.3Ω (Note 1, 2) |     | 9.5  |      | ns   |
| Rise Time                                             |                  | t <sub>R</sub>      |                                                                                                      |     | 18   |      | ns   |
| Turn-OFF Delay Time                                   |                  | t <sub>D(OFF)</sub> |                                                                                                      |     | 72   |      | ns   |
| Fall-Time                                             |                  | t <sub>F</sub>      |                                                                                                      |     | 33   |      | ns   |
| SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS       |                  |                     |                                                                                                      |     |      |      |      |
| Maximum Continuous Drain-Source Diode Forward Current |                  | I <sub>S</sub>      |                                                                                                      |     |      | 50   | A    |
| Maximum Pulsed Drain-Source Diode Forward Current     |                  | I <sub>SM</sub>     |                                                                                                      |     |      | 100  | A    |
| Drain-Source Diode Forward Voltage                    |                  | V <sub>SD</sub>     | I <sub>S</sub> =50A, V <sub>GS</sub> =0V                                                             |     |      | 1.4  | V    |
| Body Diode Reverse Recovery Time                      |                  | t <sub>rr</sub>     | I <sub>F</sub> =30A, V <sub>GS</sub> =0V, di/dt=100A/μs                                              |     | 38   |      | ns   |
| Body Diode Reverse Recovery Charge                    |                  | Q <sub>rr</sub>     |                                                                                                      |     | 28   |      | nC   |

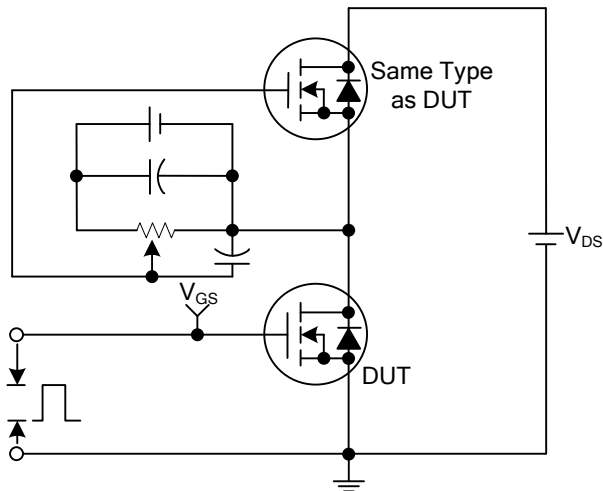
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating ambient temperature.

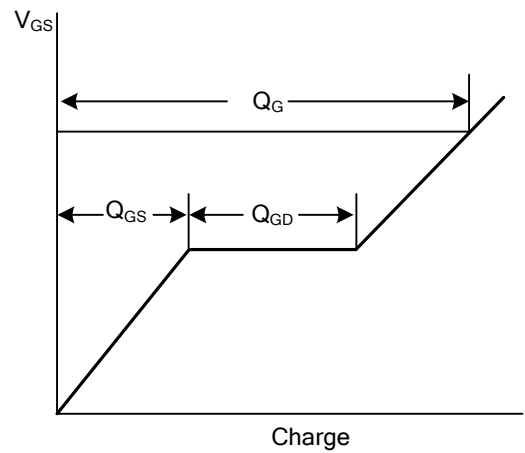
## ■ TEST CIRCUITS AND WAVEFORMS



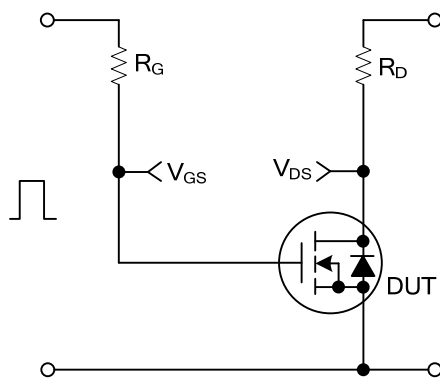
## ■ TEST CIRCUITS AND WAVEFORMS



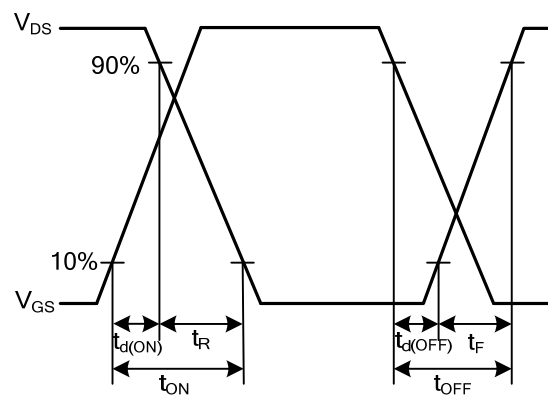
Gate Charge Test Circuit



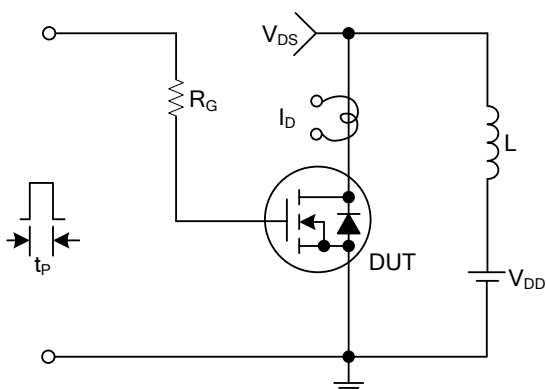
Gate Charge Waveforms



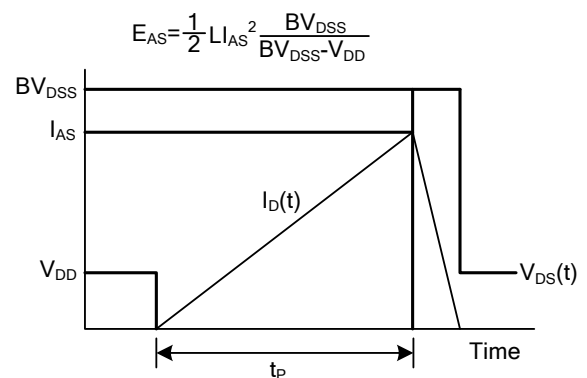
Resistive Switching Test Circuit



Resistive Switching Waveforms



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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