

#### Power MOSFET

## 50 Amps, 60 Volts N-CHANNEL POWER MOSFET

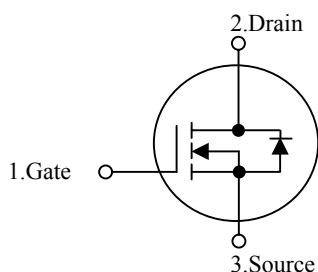
### DESCRIPTION

The FTK50N06 is three-terminal silicon device with current conduction capability of about 50A, fast switching speed. Low on-state resistance, breakdown voltage rating of 60V, and max threshold voltages of 4 volt. It is mainly suitable electronic ballast, and low power switching mode power appliances.

### FEATURES

- \*  $R_{DS(ON)} = 22m\Omega @ V_{GS} = 10V$
- \* Ultra low gate charge ( typical 30 nC )
- \* Low reverse transfer capacitance (  $C_{RSS} =$  typical 70 pF )
- \* Fast switching capability
- \* 100% avalanche energy specified
- \* Improved dv/dt capability

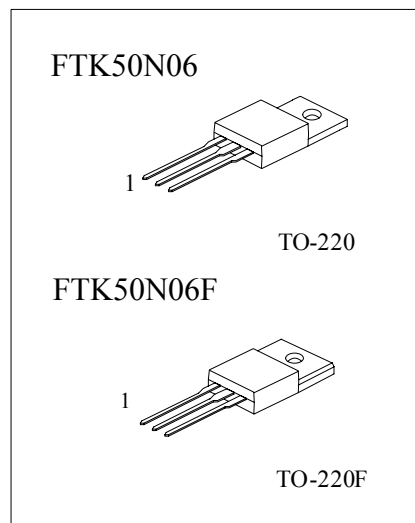
### SYMBOL



### ORDERING INFORMATION

| Order Number | Package | Pin Assignment |   |   | Packing |
|--------------|---------|----------------|---|---|---------|
|              |         | 1              | 2 | 3 |         |
| FTK50N06     | TO-220  | G              | D | S | Tube    |
| FTK50N06F    | TO-220F | G              | D | S | Tube    |

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





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### ■ ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C, unless otherwise specified)

| PARAMET                            |                        | SYMBOL           | RATINGS    | UNIT   |
|------------------------------------|------------------------|------------------|------------|--------|
| Drain-Source Voltage               |                        | V <sub>DSS</sub> | 60         | V      |
| Gate-Source Voltage                |                        | V <sub>GSS</sub> | ±20        | V      |
| Continuous Drain Current           | T <sub>C</sub> = 25°C  | I <sub>D</sub>   | 50         | A      |
|                                    | T <sub>C</sub> = 100°C |                  | 35         | A      |
| Pulsed Drain Current (Note 1)      |                        | I <sub>DM</sub>  | 200        | A      |
| Avalanche Energy                   | Single Pulse (Note 2)  | E <sub>AS</sub>  | 490        | mJ     |
|                                    | Repetitive (Note 1)    | E <sub>AR</sub>  | 12         | mJ     |
| Peak Diode Recovery dv/dt (Note 3) |                        | dv/dt            | 7          | V/ns   |
| Power Dissipation                  | T <sub>C</sub> = 25°C  | P <sub>D</sub>   | 130        | W      |
|                                    | Derate above 25°C      |                  | 0.9        | W / °C |
| Junction Temperature               |                        | T <sub>J</sub>   | +150       | °C     |
| Operating and Storage Temperature  |                        | T <sub>STG</sub> | -55 ~ +150 | °C     |

Note: 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.

### ■ THERMAL DATA

| PARAMETER           |         | SYMBOL        | RATING | UNIT   |
|---------------------|---------|---------------|--------|--------|
| Junction-to-Ambient | TO-220  | $\theta_{JA}$ | 62     | °C / W |
|                     | TO-220F |               | 62     |        |
| Junction-to-Case    | TO-220  | $\theta_{JC}$ | 1.24   |        |
|                     | TO-220F |               | 1.78   |        |

### ■ 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                                     | 60  |      |      | V      |
| Drain-Source Leakage Current              |         | I <sub>DSS</sub>                     | V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V                                      |     |      | 1    | μA     |
|                                           |         |                                      | V <sub>DS</sub> = 48V, T <sub>C</sub> = 125°C                                    |     |      | 10   | μA     |
| Gate-Body Leakage Current                 | Forward | I <sub>GSSF</sub>                    | V <sub>GS</sub> = 20V, V <sub>DS</sub> = 0V                                      |     |      | 100  | nA     |
|                                           | Reverse | I <sub>GSSR</sub>                    | V <sub>GS</sub> = -20V, V <sub>DS</sub> = 0V                                     |     |      | -100 | nA     |
| Breakdown Voltage Temperature Coefficient |         | ΔBV <sub>DSS</sub> / ΔT <sub>J</sub> | I <sub>D</sub> = 250μA,<br>Referenced to 25°C                                    |     | 0.06 |      | V / °C |
| 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      |
| Static Drain-Source On-Resistance         |         | R <sub>DS(ON)</sub>                  | V <sub>GS</sub> = 10V, I <sub>D</sub> = 25A                                      |     | 18   | 22   | mΩ     |
| DYNAMIC CHARACTERISTICS                   |         |                                      |                                                                                  |     |      |      |        |
| Input Capacitance                         |         | C <sub>ISS</sub>                     | V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V,<br>f = 1.0MHz                       |     | 1000 | 1300 | pF     |
| Output Capacitance                        |         | C <sub>OSS</sub>                     |                                                                                  |     | 450  | 590  | pF     |
| Reverse Transfer Capacitance              |         | C <sub>RSS</sub>                     |                                                                                  |     | 70   | 90   | pF     |
| SWITCHING CHARACTERISTICS                 |         |                                      |                                                                                  |     |      |      |        |
| Turn-On Delay Time                        |         | t <sub>D(ON)</sub>                   | V <sub>DD</sub> = 30V, I <sub>D</sub> = 25A, R <sub>G</sub> = 25Ω<br>(Note 4,5)  |     | 25   | 50   | ns     |
| Turn-On Rise Time                         |         | t <sub>R</sub>                       |                                                                                  |     | 120  | 240  | ns     |
| Turn-Off Delay Time                       |         | t <sub>D(OFF)</sub>                  |                                                                                  |     | 80   | 160  | ns     |
| Turn-Off Fall Time                        |         | t <sub>F</sub>                       |                                                                                  |     | 85   | 170  | ns     |
| Total Gate Charge                         |         | Q <sub>G</sub>                       | V <sub>DS</sub> = 48V, I <sub>D</sub> = 50A, V <sub>GS</sub> = 10V<br>(Note 4,5) |     | 30   | 40   | nC     |
| Gate-Source Charge                        |         | Q <sub>GS</sub>                      |                                                                                  |     | 8    |      | nC     |
| Gate-Drain Charge                         |         | Q <sub>GD</sub>                      |                                                                                  |     | 10   |      | nC     |



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### ■ ELECTRICAL CHARACTERISTICS(Cont.)

| PARAMETER                                                     | SYMBOL   | TEST CONDITIONS                                                                       | MIN | TYP | MAX | UNIT          |
|---------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|-----|-----|-----|---------------|
| <b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b> |          |                                                                                       |     |     |     |               |
| Drain-Source Diode Forward Voltage                            | $V_{SD}$ | $V_{GS} = 0\text{ V}$ , $I_S = 50\text{ A}$                                           |     |     | 1.5 | V             |
| Maximum Continuous Drain-Source Diode Forward Current         | $I_S$    |                                                                                       |     |     | 50  | A             |
| Maximum Pulsed Drain-Source Diode Forward Current             | $I_{SM}$ |                                                                                       |     |     | 200 | A             |
| Reverse Recovery Time                                         | $t_{RR}$ | $V_{GS} = 0\text{ V}$ , $I_S = 50\text{ A}$ ,<br>$di_F/dt = 100\text{ A}/\mu\text{s}$ |     | 75  |     | ns            |
| Reverse Recovery Charge                                       | $Q_{RR}$ |                                                                                       |     | 0.2 |     | $\mu\text{C}$ |

Note:

1. Repetitive Rating: Pulse width limited by  $T_J$
2.  $L = 0.38\text{mH}$ ,  $I_{AS} = 50\text{ A}$ ,  $V_{DD} = 25\text{ V}$ ,  $R_G = 20\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 50\text{ A}$ ,  $di/dt \leq 300\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

## ■ TEST CIRCUITS AND WAVEFORMS

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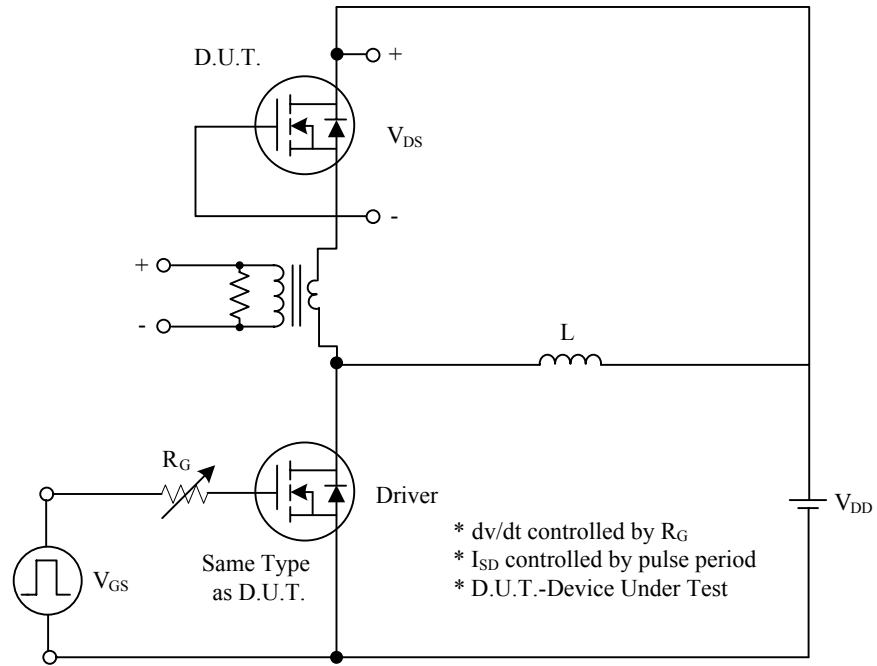


Fig. 1A Peak Diode Recovery  $dv/dt$  Test Circuit

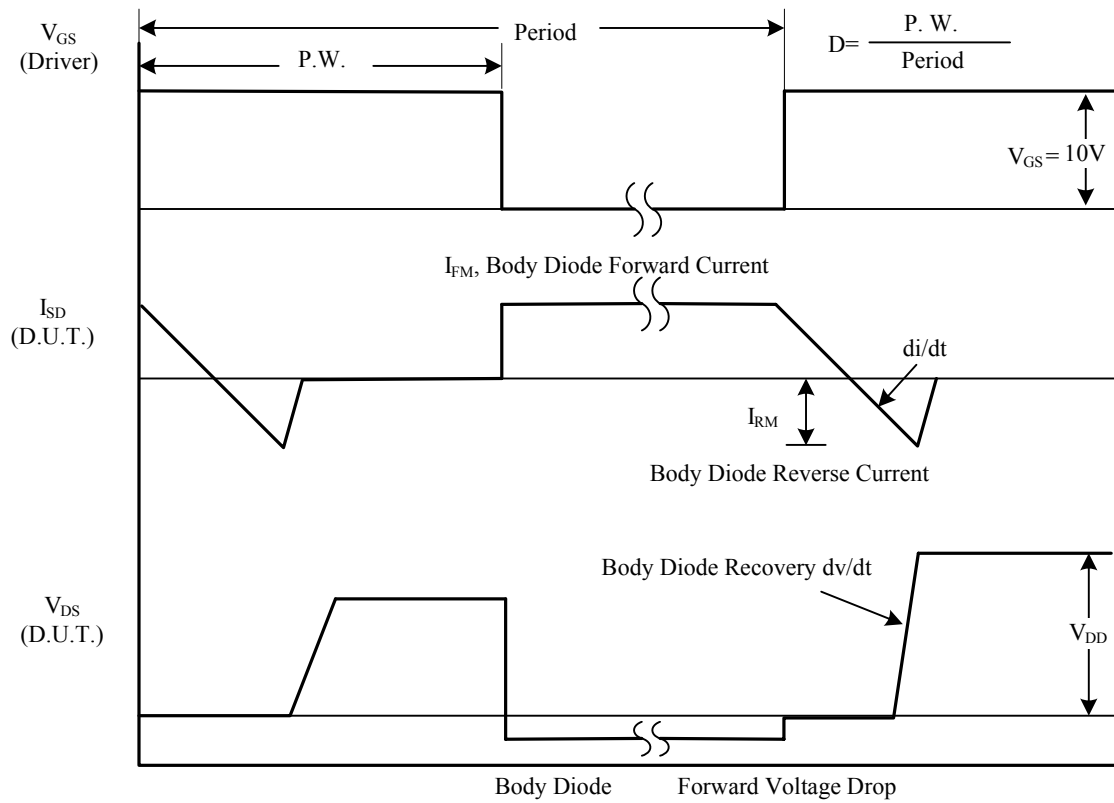


Fig. 1B Peak Diode Recovery  $dv/dt$  Waveforms

## ■ TEST CIRCUITS AND WAVEFORMS (Cont.)

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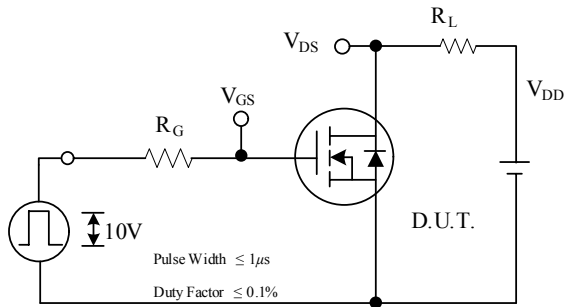


Fig. 2A Switching Test Circuit

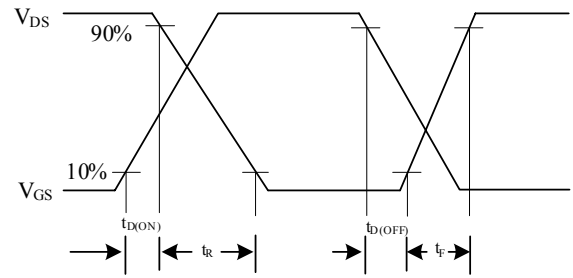


Fig. 2B Switching Waveforms

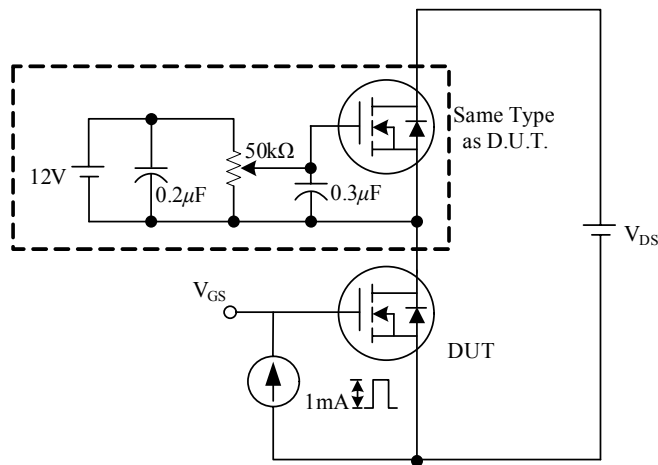


Fig. 3A Gate Charge Test Circuit

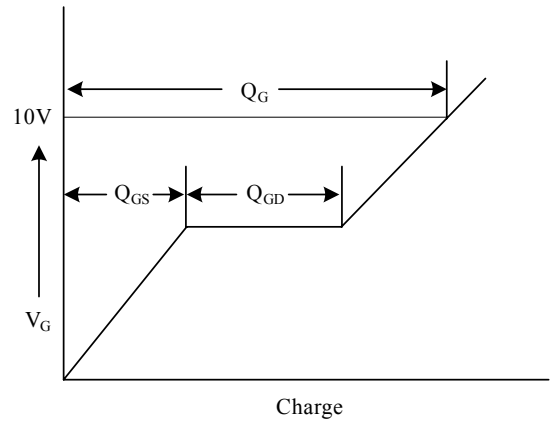


Fig. 3B Gate Charge Waveform

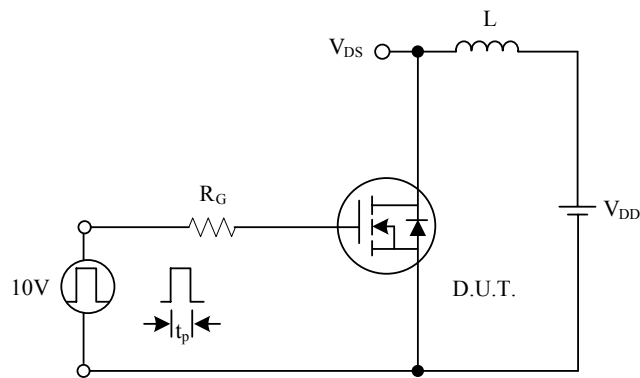


Fig. 4A Unclamped Inductive Switching Test Circuit

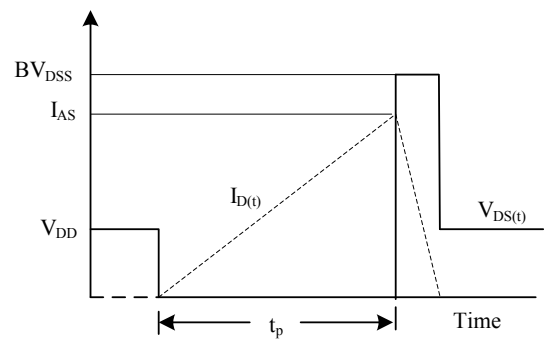
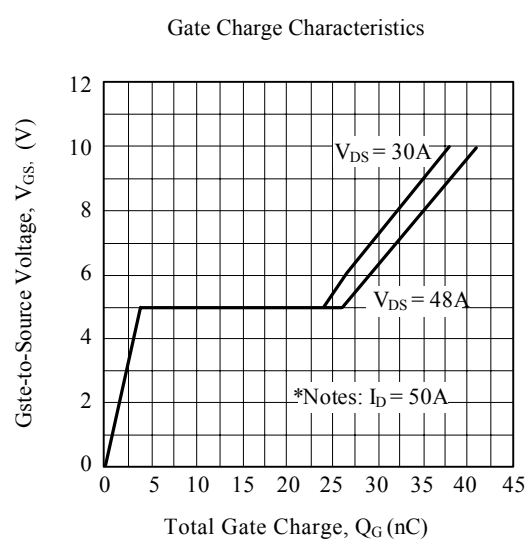
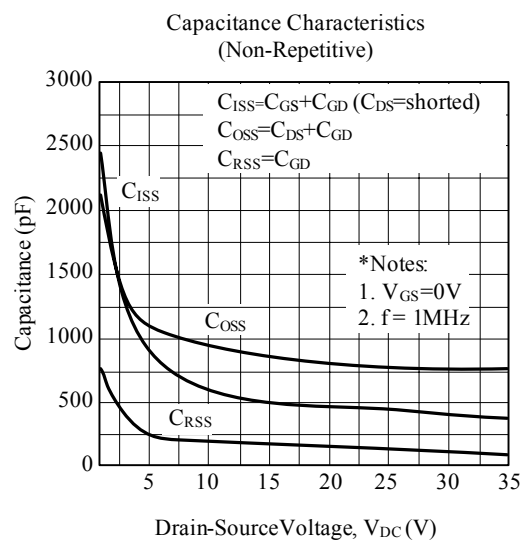
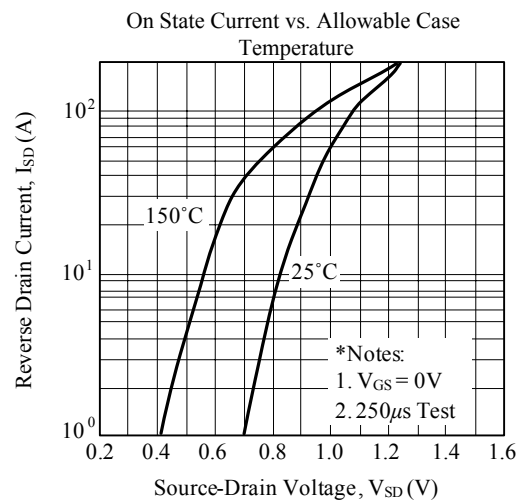
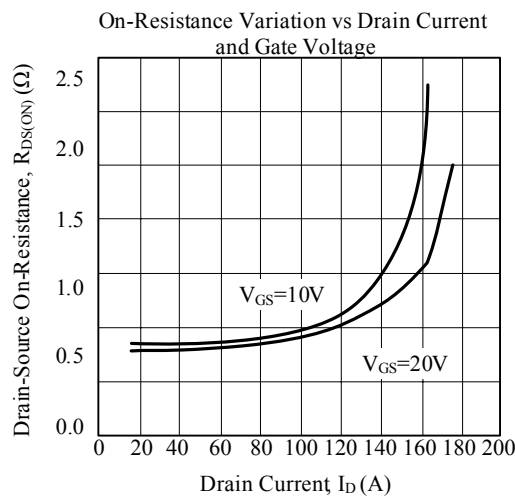
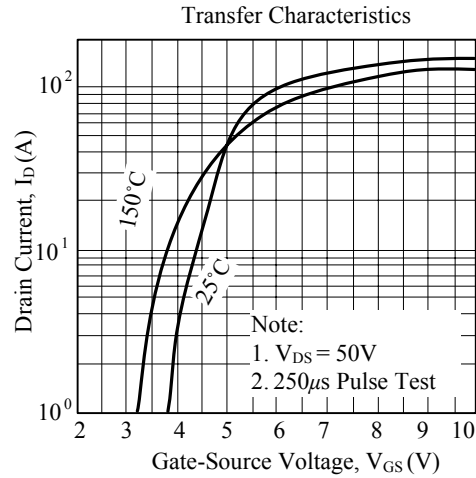
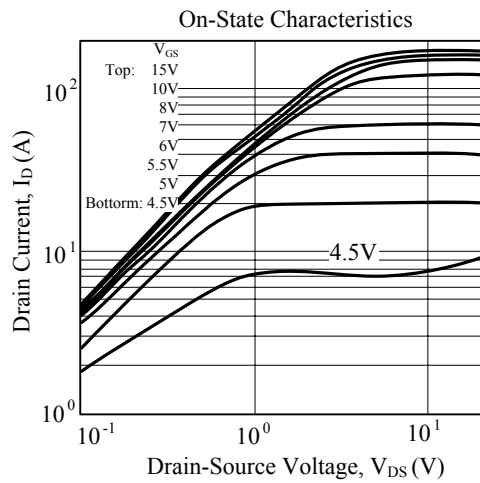


Fig. 4B Unclamped Inductive Switching Waveforms

## TYPICAL CHARACTERISTICS

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## ■ TYPICAL CHARACTERISTICS(Cont.)

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