



## N And P-Channel Enhancement Mode MOSFET

### PRIMARY CHARACTERISTICS

| N-Ch              |                             |                |
|-------------------|-----------------------------|----------------|
| BV <sub>DSS</sub> | R <sub>DS(on)</sub> MAX     | I <sub>D</sub> |
| 40V               | 22mΩ@V <sub>GS</sub> =10V   | 10A            |
|                   | 31mΩ@V <sub>GS</sub> =4.5V  |                |
| P-Ch              |                             |                |
| BV <sub>DSS</sub> | R <sub>DS(on)</sub> MAX     | I <sub>D</sub> |
| -40V              | 44mΩ@V <sub>GS</sub> =-10V  | -10A           |
|                   | 60mΩ@V <sub>GS</sub> =-4.5V |                |

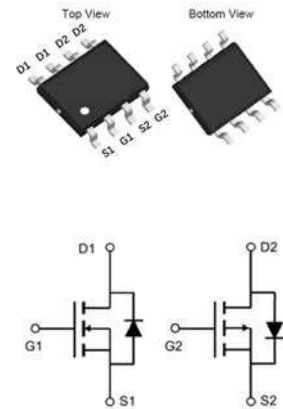
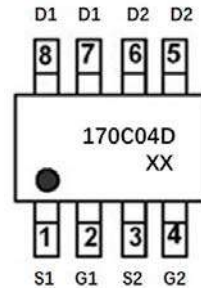
### GENERAL DESCRIPTION

- Excellent Gate Charge x R<sub>DS(ON)</sub> Product(FOM)
- Very Low On-resistance R<sub>DS(ON)</sub>
- Fast Switching Speed

### SOP-8

### PACKAGE

Marking :



### MECHANICAL DATA

- Case : Molded plastic,SOP-8
- Polarity : Shown above
- Terminals :Plated terminals, solderable per MIL-STD-750,Method 2026
- Epoxy : UL94-V0 rated flame retardant

### Absolute Maximum Ratings (T<sub>A</sub>=25°C unless otherwise specified)

| Symbol                            | Parameter                               | Max. N-Channel         | Max. P-Channel | Units |
|-----------------------------------|-----------------------------------------|------------------------|----------------|-------|
| V <sub>DSS</sub>                  | Drain-Source Voltage                    | 40                     | -40            | V     |
| V <sub>GSS</sub>                  | Gate-Source Voltage                     | ±20                    | ±20            | V     |
| I <sub>D</sub>                    | Continuous Drain Current                | T <sub>A</sub> = 25°C  | 10             | A     |
|                                   |                                         | T <sub>A</sub> = 100°C | 6.5            | A     |
| I <sub>DM</sub>                   | Pulsed Drain Current <sup>note1</sup>   | 40                     | -40            | A     |
| P <sub>D</sub>                    | Power Dissipation                       | T <sub>A</sub> = 25°C  | 4              | W     |
| R <sub>θJA</sub>                  | Thermal Resistance, Junction to Ambient | 31.3                   | 16.7           | °C/W  |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Temperature Range | -55 to +150            |                | °C    |



## N And P-Channel Enhancement Mode MOSFET

N-Channel Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise specified)

| Symbol                                                 | Parameter                                                | Test Condition                                                                           | Min. | Typ. | Max. | Units |
|--------------------------------------------------------|----------------------------------------------------------|------------------------------------------------------------------------------------------|------|------|------|-------|
| Off Characteristic                                     |                                                          |                                                                                          |      |      |      |       |
| V <sub>(BR)DSS</sub>                                   | Drain-Source Breakdown Voltage                           | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                               | 40   | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                          | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V                                                | -    | -    | 1.0  | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                             | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                               | -    | -    | ±100 | nA    |
| On Characteristics                                     |                                                          |                                                                                          |      |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                   | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                 | 1.0  | 1.5  | 2.5  | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br>note2               | V <sub>GS</sub> =10V, I <sub>D</sub> =15A                                                | -    | 16   | 22   | mΩ    |
|                                                        |                                                          | V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A                                               | -    | 22   | 31   | mΩ    |
| Dynamic Characteristics                                |                                                          |                                                                                          |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                        | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V,<br>f=1.0MHz                                   | -    | 1050 | -    | pF    |
| C <sub>oss</sub>                                       | Output Capacitance                                       |                                                                                          | -    | 84   | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                             |                                                                                          | -    | 72   | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                        | V <sub>DS</sub> =20V, I <sub>D</sub> =5A,<br>V <sub>GS</sub> =10V                        | -    | 11   | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                       |                                                                                          | -    | 1.9  | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                              |                                                                                          | -    | 2.2  | -    | nC    |
| Switching Characteristics                              |                                                          |                                                                                          |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                       | V <sub>DS</sub> =20V, I <sub>D</sub> = 5A,<br>R <sub>L</sub> =2.5Ω, R <sub>REN</sub> =3Ω | -    | 11   | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                        |                                                                                          | -    | 13   | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                      |                                                                                          | -    | 36   | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                       |                                                                                          | -    | 9    | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                          |                                                                                          |      |      |      |       |
| I <sub>S</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current |                                                                                          | -    | -    | 10   | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current     |                                                                                          | -    | -    | 40   | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> =0V, I <sub>S</sub> = 10A                                                | -    | -0.8 | -1.2 | V     |
| t <sub>rr</sub>                                        | Body Diode Reverse Recovery Time                         | T <sub>J</sub> =25℃,                                                                     | -    | 19   | -    | ns    |
| Q <sub>rr</sub>                                        | Body Diode Reverse Recovery                              | I <sub>F</sub> =10A,dI/dt=100A/μs                                                        | -    | 11   | -    | nC    |

Notes: 1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

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

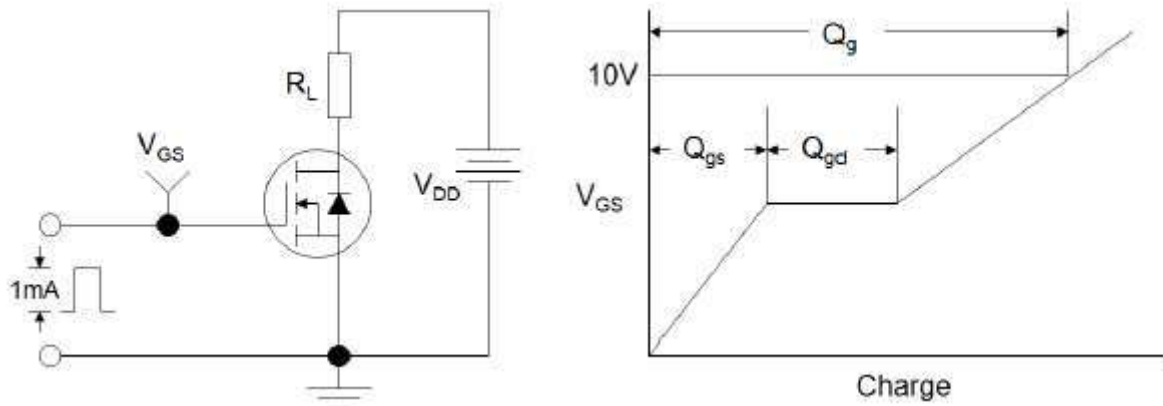
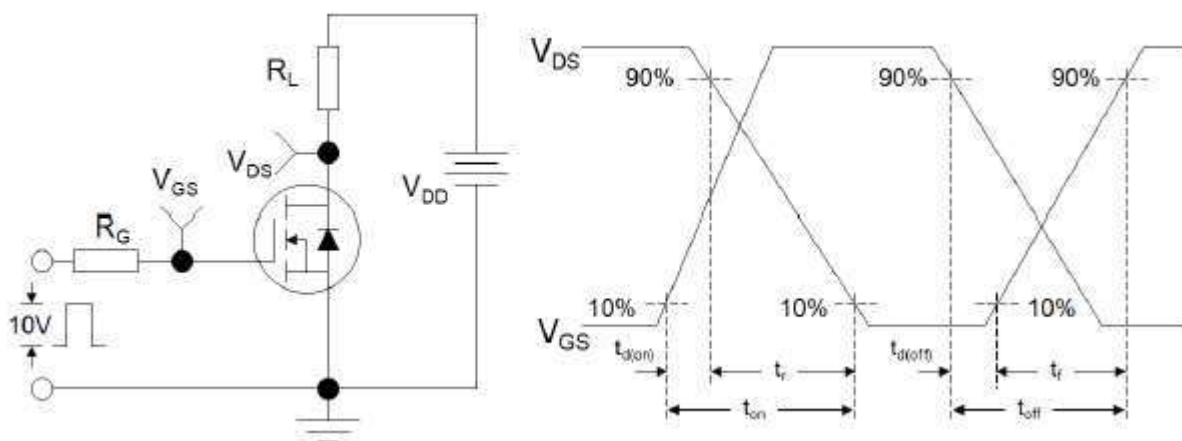
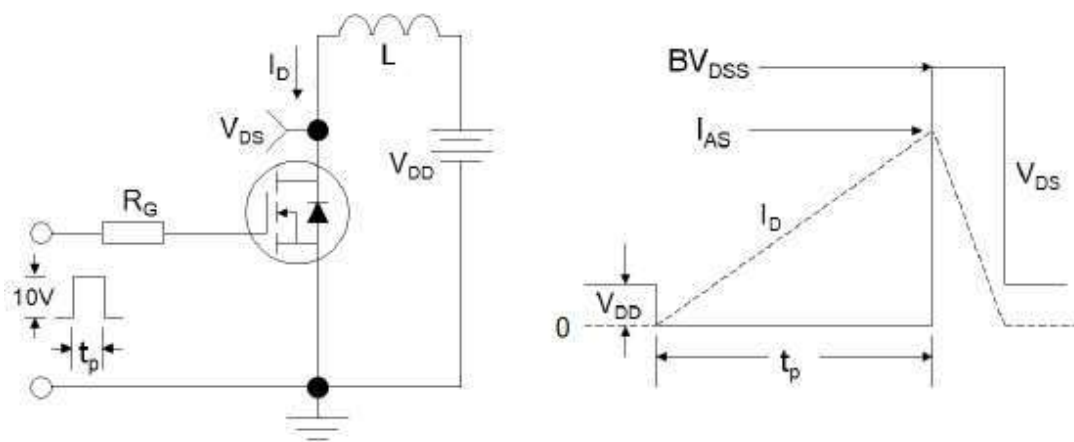


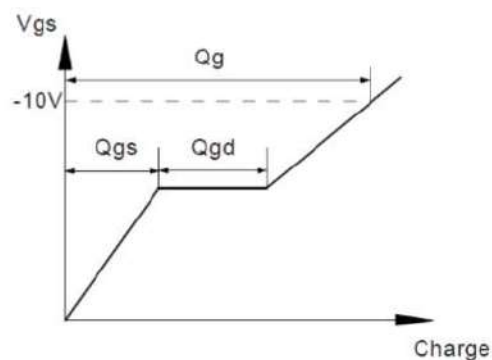
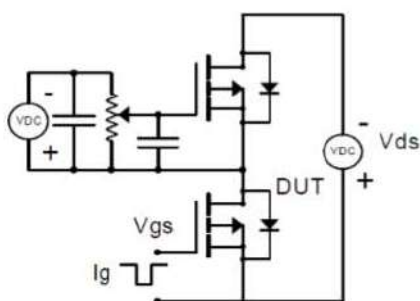
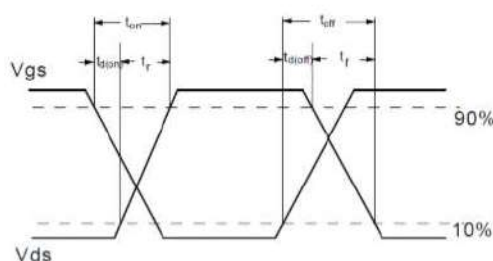
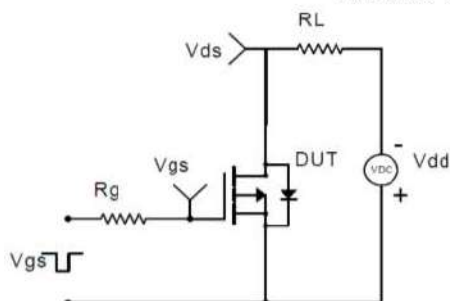
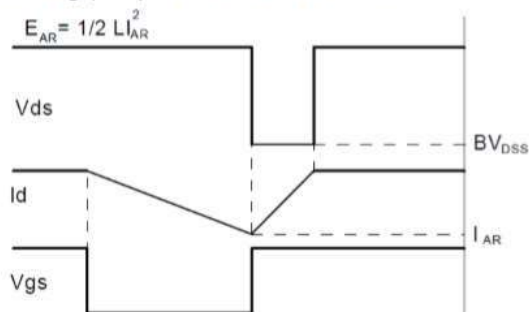
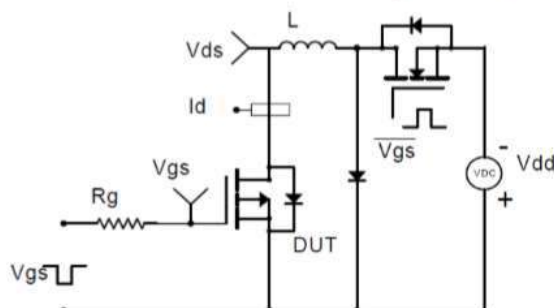
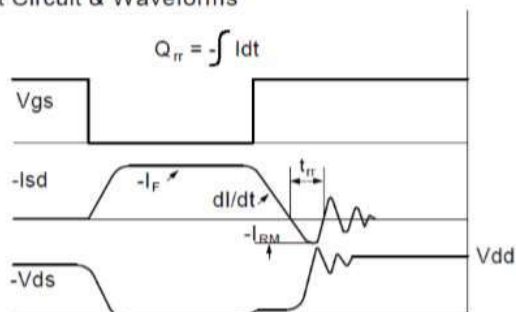
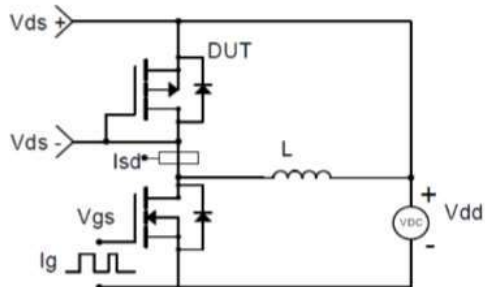
## N And P-Channel Enhancement Mode MOSFET

### P-Channel Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise specified)

| Symbol                                                 | Parameter                                                | Test Condition                                                                                  | Min. | Typ. | Max. | Units |
|--------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------------------------------------------------|------|------|------|-------|
| Off Characteristic                                     |                                                          |                                                                                                 |      |      |      |       |
| V <sub>(BR)DSS</sub>                                   | Drain-Source Breakdown Voltage                           | V <sub>GS</sub> =0V, I <sub>D</sub> = -250μA                                                    | -40  | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                          | V <sub>DS</sub> = -40V, V <sub>GS</sub> =0V                                                     | -    | -    | -1   | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                             | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                                      | -    | -    | ±100 | nA    |
| On Characteristics                                     |                                                          |                                                                                                 |      |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                   | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = -250μA                                      | -1.0 | -1.6 | -2.5 | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br>note3               | V <sub>GS</sub> = -10V, I <sub>D</sub> = -8A                                                    | -    | 34   | 44   | mΩ    |
|                                                        |                                                          | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -5A                                                   | -    | 44   | 60   |       |
| Dynamic Characteristics                                |                                                          |                                                                                                 |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                        | V <sub>DS</sub> = -20V, V <sub>GS</sub> =0V,<br>f=1.0MHz                                        | -    | 1160 | -    | pF    |
| C <sub>Oss</sub>                                       | Output Capacitance                                       |                                                                                                 | -    | 155  | -    | pF    |
| C <sub>rSS</sub>                                       | Reverse Transfer Capacitance                             |                                                                                                 | -    | 98   | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                        | V <sub>DS</sub> = -20V, I <sub>D</sub> = -5A,<br>V <sub>GS</sub> = -10V                         | -    | 20   | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                       |                                                                                                 | -    | 3.5  | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                              |                                                                                                 | -    | 4.2  | -    | nC    |
| Switching Characteristics                              |                                                          |                                                                                                 |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                       | V <sub>DD</sub> = -20V, I <sub>D</sub> = -5A,<br>V <sub>GS</sub> = -10V, R <sub>GEN</sub> =2.5Ω | -    | 8    | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                        |                                                                                                 | -    | 15   | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                      |                                                                                                 | -    | 23   | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                       |                                                                                                 | -    | 9    | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                          |                                                                                                 |      |      |      |       |
| I <sub>S</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current |                                                                                                 | -    | -    | -10  | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current     |                                                                                                 | -    | -    | -40  | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> =0V, I <sub>S</sub> = -10A                                                      | -    | -0.8 | -1.2 | V     |
| trr                                                    | Reverse Recovery Time                                    | T <sub>J</sub> =25 °C                                                                           | -    | 29   | -    | ns    |
| Qrr                                                    | Reverse Recovery Charge                                  | I <sub>F</sub> =10A, dI/dt=100A/μs                                                              | -    | 20   | -    | nC    |

Notes: 3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

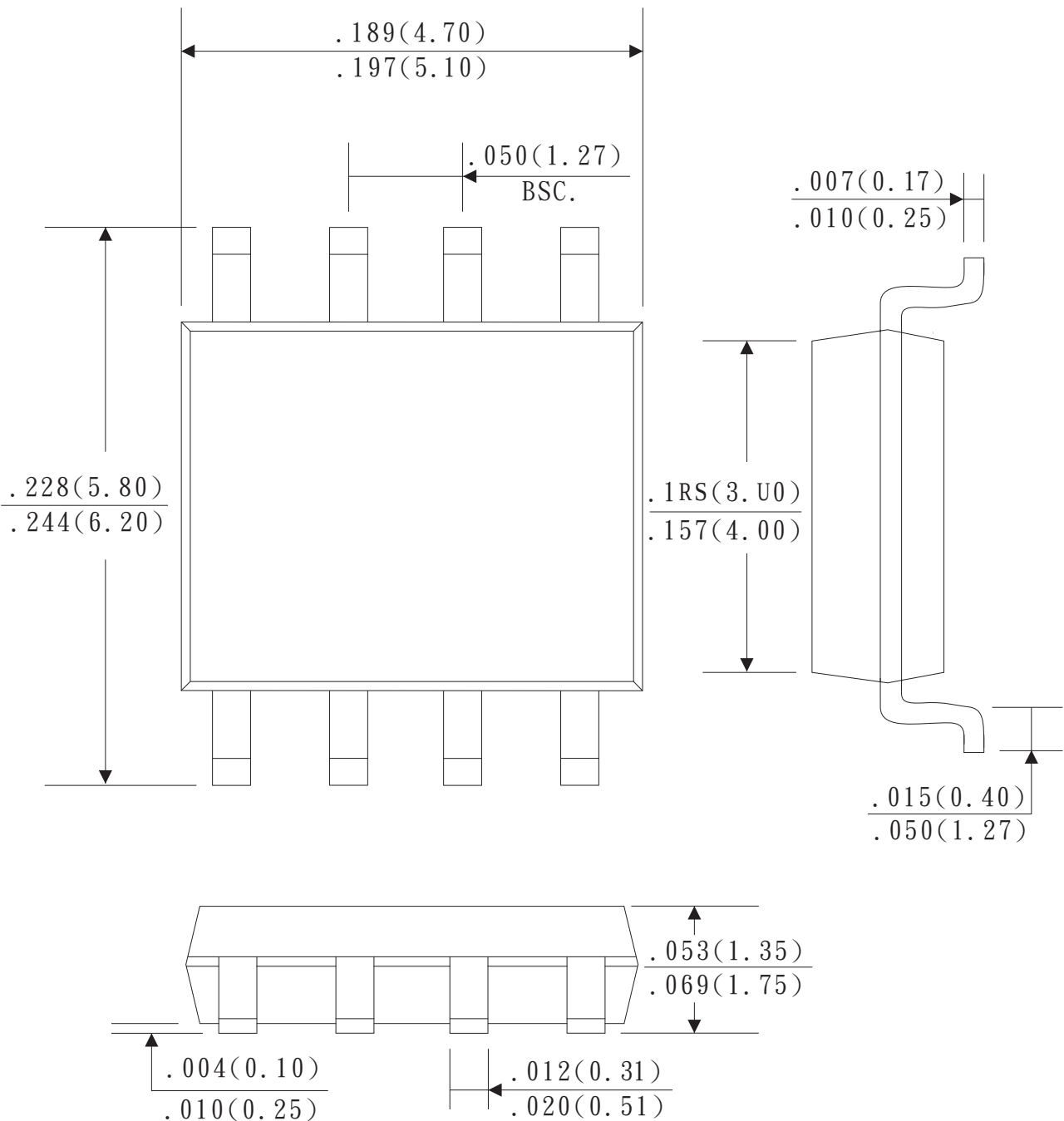
**Test Circuit-N**

**Figure1:Gate Charge Test Circuit & Waveform**

**Figure 2: Resistive Switching Test Circuit & Waveforms**

**Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms**

**Test Circuit-P**
**Gate Charge Test Circuit & Waveform**

**Resistive Switching Test Circuit & Waveforms**

**Unclamped Inductive Switching (UIS) Test Circuit & Waveforms**

**Diode Recovery Test Circuit & Waveforms**




## Outline Drawing

## SOP-8



Dimensions in inches and (millimeters)

Rev.D

**Ordering Information:**

| Device PN                                                       | Packing                |
|-----------------------------------------------------------------|------------------------|
| SEQ40NP10 -T <sup>(1)</sup> H <sup>(2)</sup> -WS <sup>(3)</sup> | Tape&Reel: 4 Kpcs/Reel |

Note: (1) Packing code, Tape & Reel Packing

(2) Halogen free product for packing code suffix "H"

(3) WS : Willas brand abbreviation, Label Type does not display

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