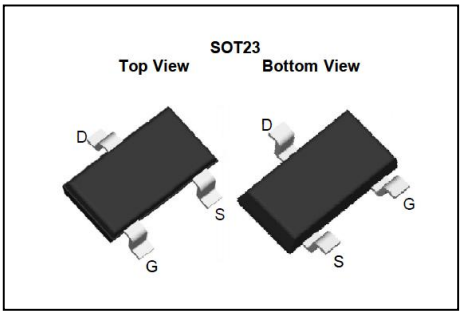
# Silicon N-Channel Power MOSFET

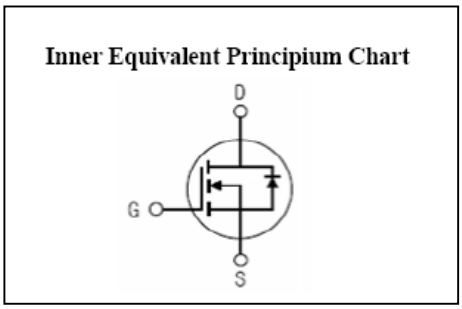
## CS01N60 ASRD-G

## General Description:

CS01N60 ASRD-G, the silicon N-channel Enhanced VDMOSFETs, is obtained by the self-aligned planar Technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. The transistor can be used in various power switching circuit for system miniaturization and higher efficiency. The package form is SOT-23, which accords with the RoHS standard.

| | | |
|---|---|---|
| $V_{DSS}$ | 600 | V |
| $I_D$ | 0.04 | A |
| $P_D(T_A=25℃)$ | 0.5 | W |
| $R_{DS(ON)Typ}$ | 160 | Ω |




## Features:

- **Fast Switching**
- **Low ON Resistance(Rdson≤500Ω)**
- **Low Gate Charge (Typical Data:3.1nC)**
- **Low Reverse transfer capacitances(Typical:1.3pF)**
- **Halogen Free**

## Applications:

TV power.

**Absolute**（Tc= 25℃ unless otherwise specified）:

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-to-Source Voltage | 600 | V |
| $I_D$ | Continuous Drain Current | 0.04 | A |
| | Continuous Drain Current $T_C$ = 100 °C | 0.02 | A |
| $I_{DM}$ [a1] | Pulsed Drain Current | 0.16 | A |
| $V_{GS}$ | Gate-to-Source Voltage | ±20 | V |
| dv/dt [a2] | Peak Diode Recovery dv/dt | 5.0 | V/ns |
| $P_D$ | Power Dissipation ($T_A$=25℃) | 0.5 | W |
| $V_{ESD(G-S)}$ | Gate source ESD (HBM-C= 100pF, R=1.5kΩ) | 2000 | V |
| $T_J$, $T_{stg}$ | Operating Junction and Storage Temperature Range | 150，–55 to 150 | ℃ |

**Electrical Characteristics**（Tc= 25℃ unless otherwise specified）:

| **OFF Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Unit |
| | | | Min. | Typ. | Max. | s |
| $V_{DSS}$ | Drain to Source Breakdown Voltage | $V_{GS}$=0V, $I_D$=250μA | 600 | -- | -- | V |
| $\Delta BV_{DSS}/\Delta T_J$ | Bvdss Temperature Coefficient | ID=250uA,Reference25℃ | -- | 0.6 | -- | V/℃ |
| $I_{DSS}$ | Drain to Source Leakage Current | $V_{DS}$ =600V, $V_{GS}$= 0V, $T_a$ = 25℃ | -- | -- | 1 | μA |
| | | $V_{DS}$ =480V, $V_{GS}$= 0V, $T_a$ = 125℃ | -- | -- | 100 | μA |
| $I_{GSS(F)}$ | Gate to Source Forward Leakage | $V_{GS}$ =+20V | -- | -- | 10 | uA |
| $I_{GSS(R)}$ | Gate to Source Reverse Leakage | $V_{GS}$ =-20V | -- | -- | -10 | uA |

| **ON Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $R_{DS(ON)}$ | Drain-to-Source On-Resistance | $V_{GS}$=10V,$I_D$=0.016A | -- | 160 | 500 | Ω |
| | | $V_{GS}$=4.5V,$I_D$=0.016A | -- | 180 | 600 | Ω |
| $V_{GS(TH)}$ | Gate Threshold Voltage | $V_{DS}$ = 5V, $I_D$ =8μA | 1.4 | 2.0 | 3.2 | V |
| Pulse width tp≤300μs, δ ≤2% | | | | | | |

| **Dynamic Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| Rg | Gate resistance | f = 1.0MHz | 3 | 15 | 27 | Ω |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=40V, $I_D$ =0.016A | 0.04 | 0.07 | 0.11 | S |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V $V_{DS}$ = 25V f = 1.0MHz | 11.4 | 16.3 | 21.1 | pF |
| $C_{oss}$ | Output Capacitance | | 0.1 | 0.2 | 0.3 | |
| $C_{rss}$ | Reverse Transfer Capacitance | | 0.3 | 1.3 | 2.4 | |

| **Resistive Switching Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $t_{d(ON)}$ | Turn-on Delay Time | ID =16mA VDD = 300V RG =10Ω | -- | 6.5 | 13.0 | ns |
| tr | Rise Time | | -- | 6.9 | 13.9 | |
| $t_{d(OFF)}$ | Turn-Off Delay Time | | -- | 13.9 | 27.8 | |
| $t_f$ | Fall Time | | -- | 8.5 | 17.1 | |
| $Q_g$ | Total Gate Charge | $I_D$ =0.2A $V_{DD}$ =400V $V_{GS}$ = 10V | 1.6 | 3.1 | 4.7 | nC |
| $Q_{gs}$ | Gate to Source Charge | | 0.07 | 0.4 | 0.7 | |
| $Q_{gd}$ | Gate to Drain (“Miller”)Charge | | 0.4 | 1.9 | 3.4 | |

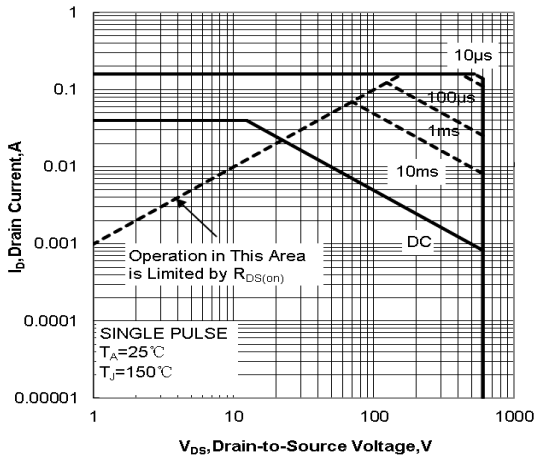
| Source-Drain Diode Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $I_S$ | Continuous Source Current (Body Diode) | | -- | -- | 0.04 | A |
| $I_{SM}$ | Maximum Pulsed Current (Body Diode) | | -- | -- | 0.16 | A |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=0.016A,$V_{GS}$=0V | -- | -- | 1.5 | V |
| trr | Reverse Recovery Time | $I_S$=16mA,$T_j$ = 25℃ | 65 | 130 | 195 | ns |
| Qrr | Reverse Recovery Charge | $dI_F/dt$=100A/us, $V_{GS}$=0V | 7 | 14 | 21 | nC |
| Pulse width tp≤300μs, δ ≤2% | | | | | | |

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| $R_{\theta JA}$ | Junction-to-Ambient | 250 | ℃/W |

[a1]: Repetitive rating; pulse width limited by maximum junction temperature

[a2]: $I_{SD}$ =0.01A,di/dt ≤100A/us,$V_{DD}$≤$BV_{DS,}$ Start $T_J$=25℃

## Characteristics Curve:



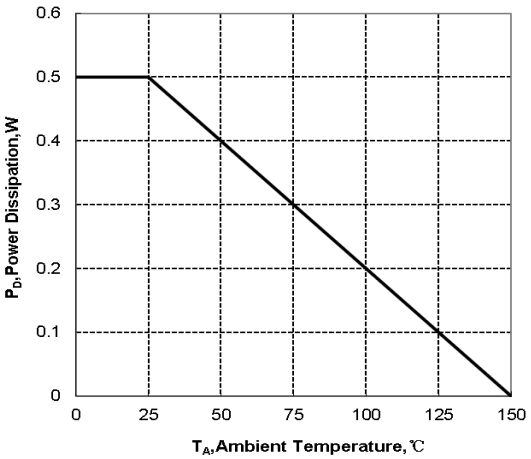
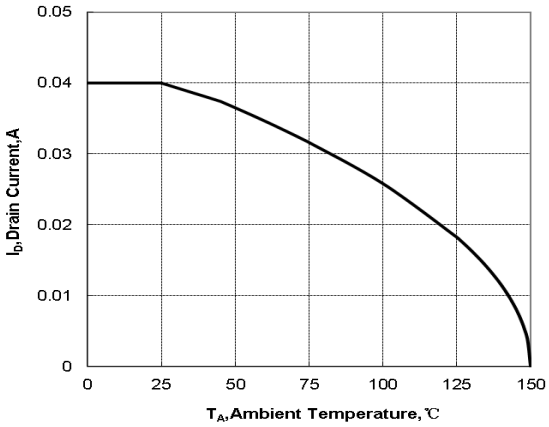




Figure.1 Maximum Forward Bias Safe Operating Area  Figure.2 Maximum Power Dissipation vs Ambient Temperature



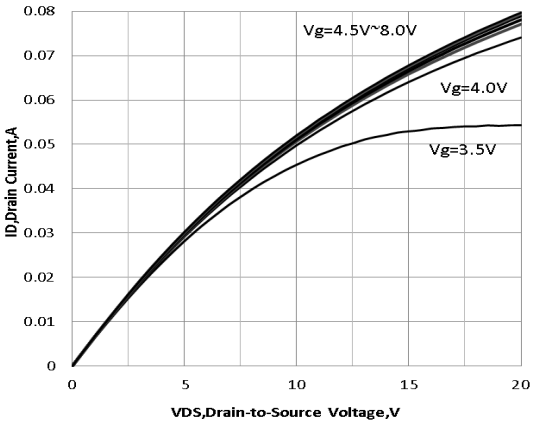




Figure.3 Maximum Continuous Drain Current vs Ambient Temperature  Figure.4 Typical Output Characteristics

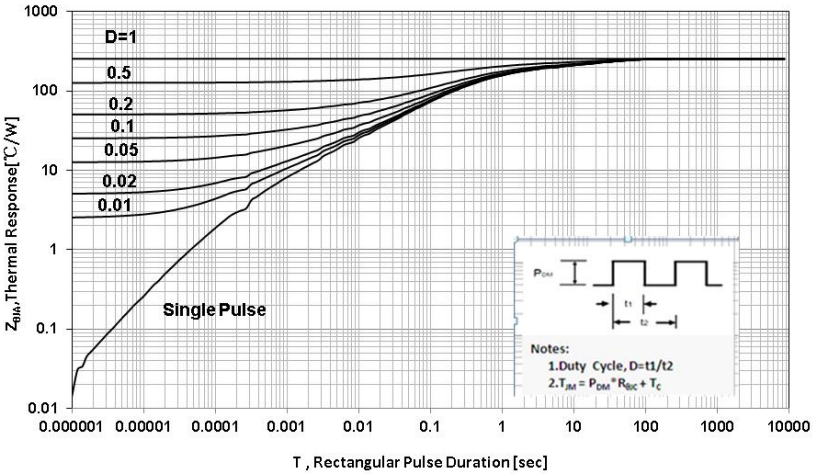



Figure.5  Maximum Effective Thermal Impedance , Junction to Ambient

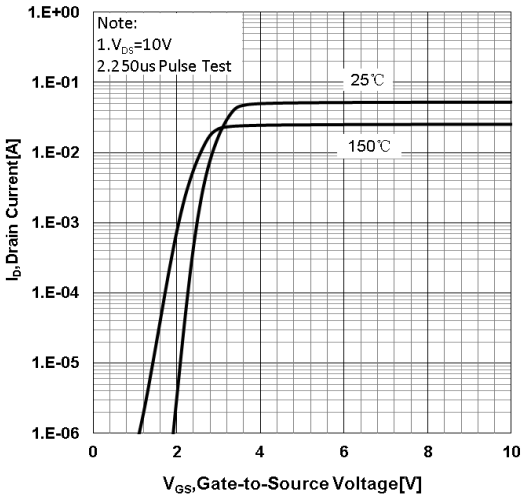



Figure.6 Typical Transfer Characteristics

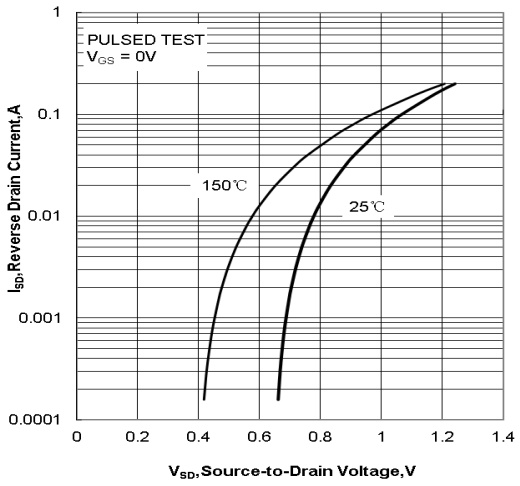



Figure.7 Typical Body Diode Transfer Characteristics

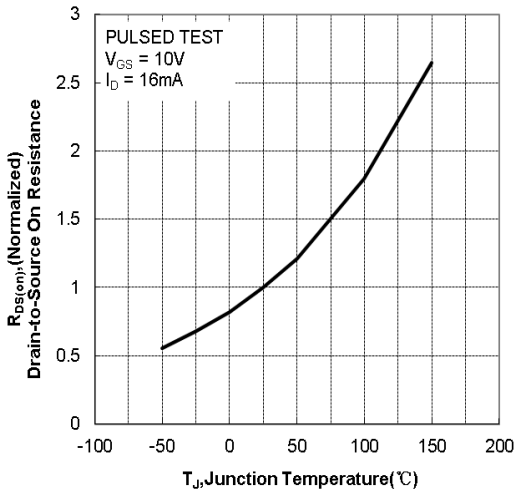



Figure.8 Typical Drian to Source on Resistance vs Junction Temperature

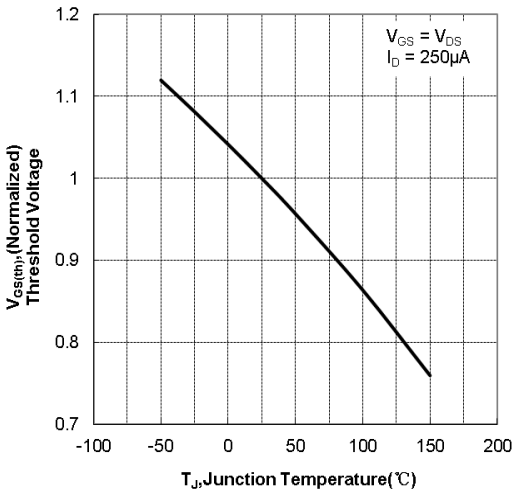



Figure.9 Typical Theshold Voltage vs Junction Temperature

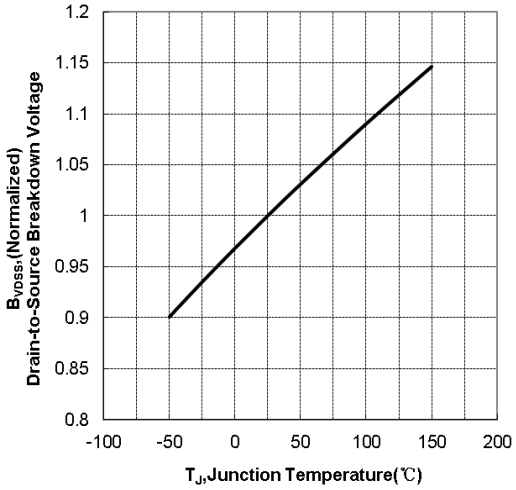



Figure.10 Typical Breakdown Voltage vs Junction Temperature

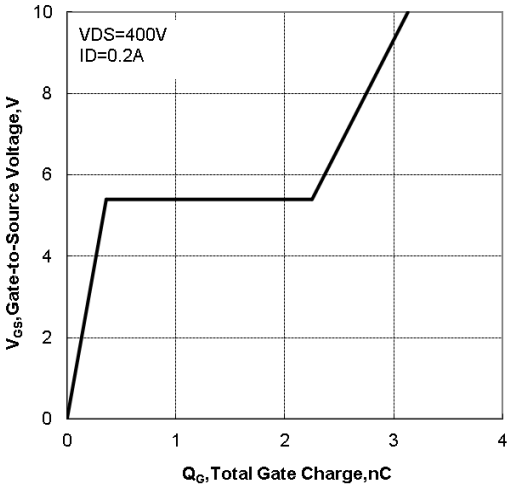



Figure.11 Typical Gate Charge vs Gate to Source Voltage Temperature

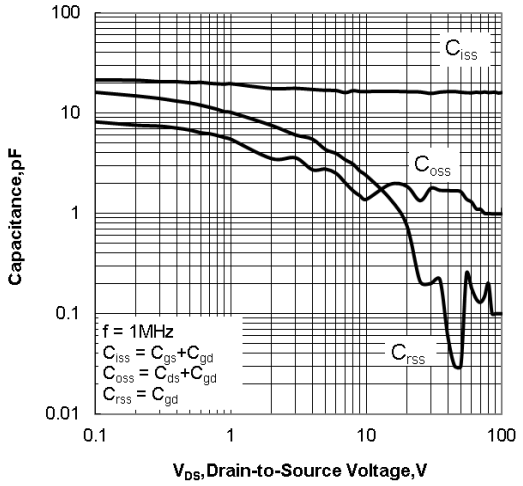



Figure.12 Typical Capacitance vs Drain to Source Voltage

## Test Circuit and Waveform

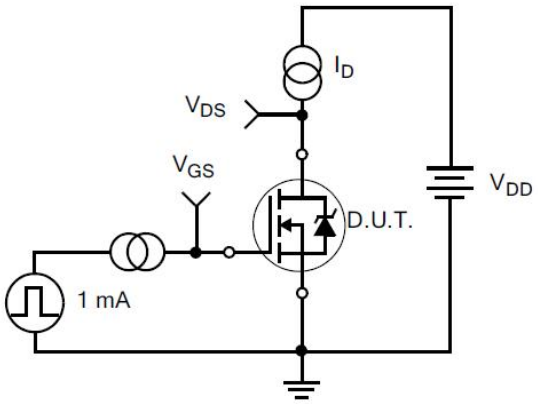



Figure 13. Gate Charge Test Circuit

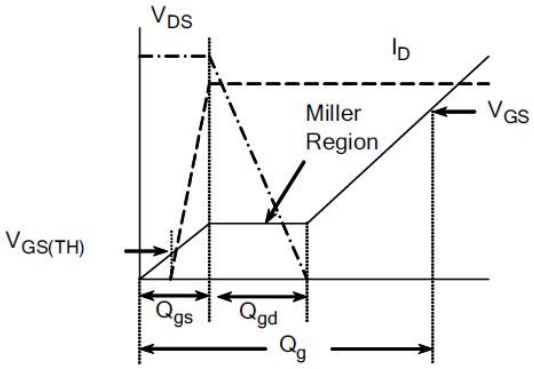



Figure 14. Gate Charge Waveforms

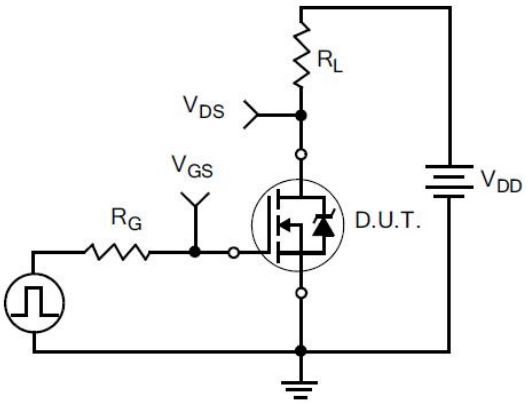



Figure 15. Resistive Switching Test Circuit

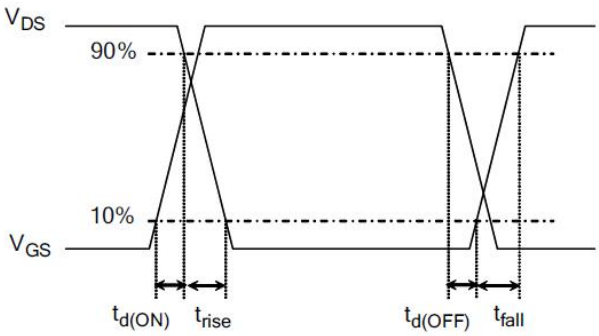



Figure 16. Resistive Switching Waveforms

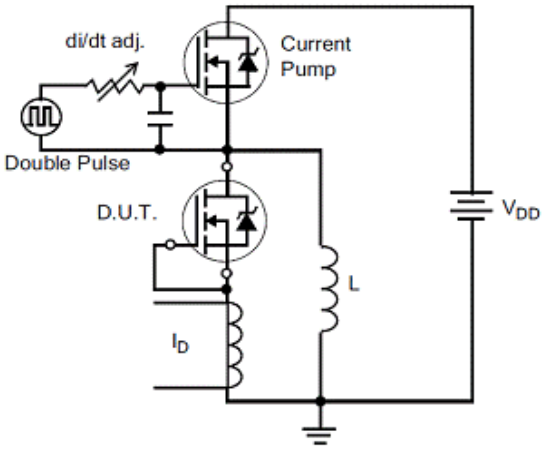



Figure 17. Diode Reverse Recovery Test Circuit

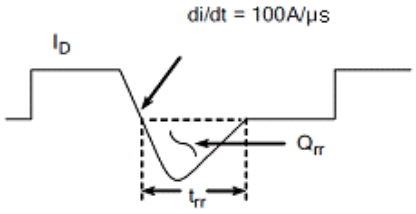



Figure 18. Diode Reverse Recovery Waveform

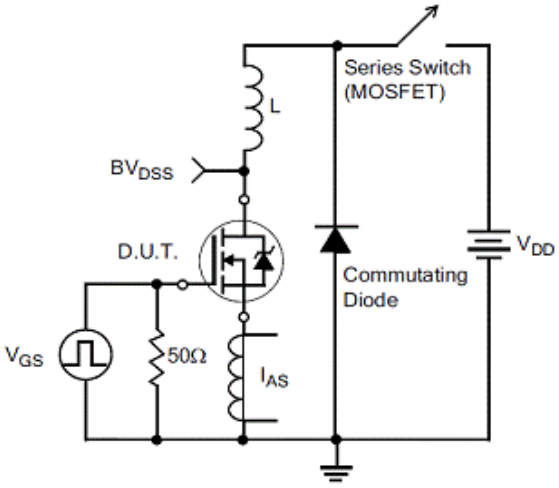



Figure19.Unclamped Inductive Switching Test Circuit

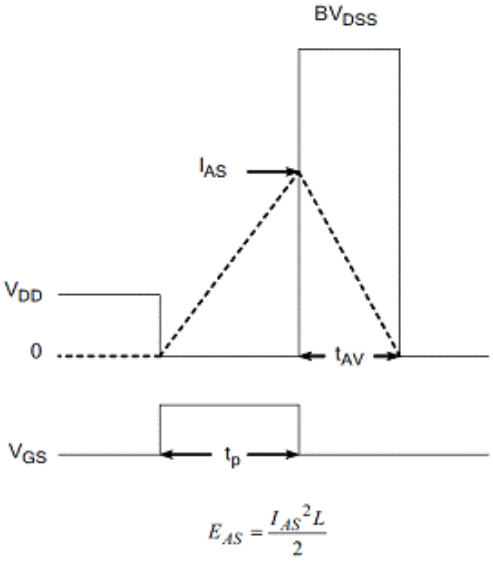
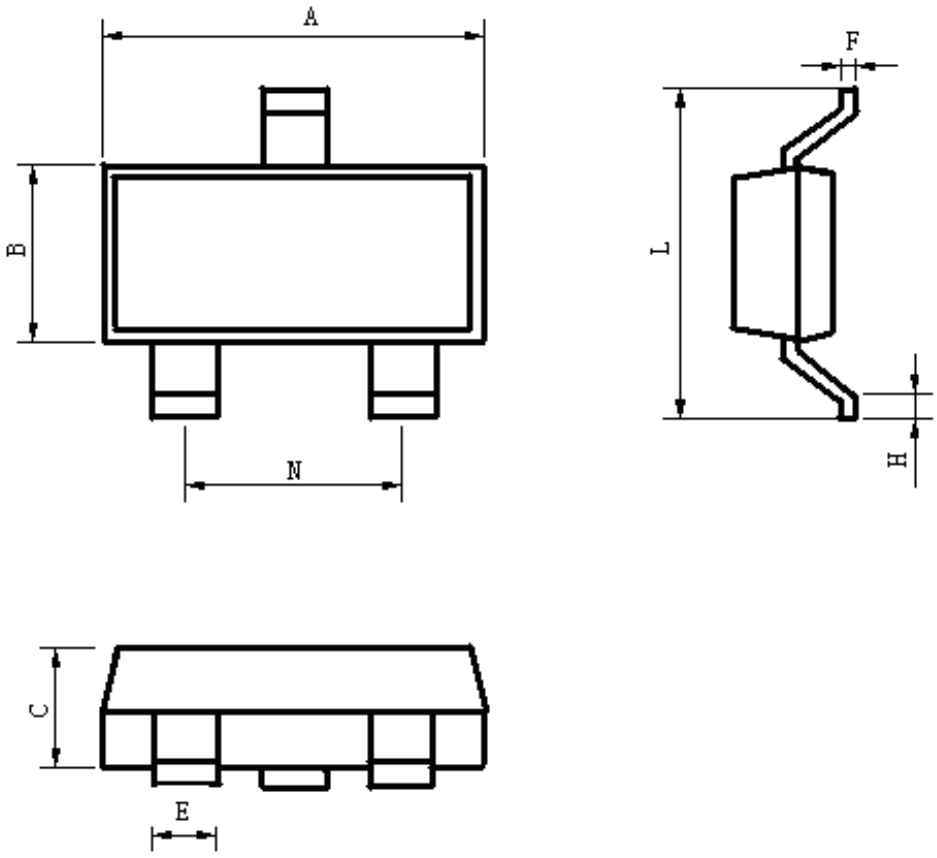



Figure20.Unclamped Inductive Switching Waveform

## Package Information：




| Items | Values(mm) | |
|---|---|---|
| | MIN | MAX |
| A | 2.70 | 3.10 |
| B | 1.10 | 1.50 |
| C | 0.90 | 1.10 |
| E | 0.25 | 0.55 |
| F | 0.07 | 0.23 |
| H | 0.25 | 0.55 |
| L | 2.20 | 2.60 |
| N | 1.80 | 2.00 |

SOT-23 Package

**The name and content of poisonous and harmful material in products**

| Part's Name | Hazardous Substance | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pb | Hg | Cd | Cr(VI) | PBB | PBDE | DIBP | DEHP | DBP | BBP |
| Limit | ≤0.1% | ≤0.1% | ≤0.01 % | ≤0.1% | ≤0.1% | ≤0.1% | ≤0.1% | ≤0.1% | ≤0.1% | ≤0.1% |
| Lead Frame | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Molding | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Chip | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Wire Bonding | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Electric glue | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Note | ○：Means the hazardous material is under the criterion of 2011/65/EU.<br>×：Means the hazardous material exceeds the criterion of 2011/65/EU.<br>The plumbum element of solder exist in products presently, but within the allowed range of Eurogroup's RoHS. | | | | | | | | | |

## Warnings

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. It is suggested to be used under 80 percent of the maximum ratings of the device.
2. When installing the heatsink, please pay attention to the torsional moment and the smoothness of the heatsink.
3. VDMOSFETs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. This publication is made by Huajing Microelectronics and subject to regular change without notice.

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