# Silicon N-Channel Power MOSFET

# CS10N045 AE-G

| | | |
|---|---|---|
| $V_{DSS}$ | 45 | V |
| $I_D$ | 10 | A |
| $P_D(T_a=25℃)$ | 2.9 | W |
| $R_{DS(ON)\ Typ@Vgs=10V}$ | 10 | mΩ |
| $R_{DS(ON)\ Typ@Vgs=4.5V}$ | 12.5 | mΩ |

## General Description：

CS10N045 AE-G, the silicon N-channel Enhanced VDMOSFETs, is obtained by the high density Trench 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 SOP8, which accords with the Halogen Free standard.

## Features：

- **Fast Switching**
- **Low ON Resistance**
- **Low Gate Charge**
- **Low Reverse transfer capacitances**
- **100% Single Pulse avalanche energy Test**
- **Halogen Free**

## Applications：

Power switch circuit of adaptor and charger.

D D D D
8 7 6 5
1 2 3 4
S S S G

SOP-8 top view

## Absolute（$T_A$= 25℃ unless otherwise specified）：

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-to-Source Voltage | 45 | V |
| $I_D$ | Continuous Drain Current | 10 | A |
| | Continuous Drain Current $T_A = 100$ ℃ | 7.6 | A |
| $I_{DM}$ [a1] | Pulsed Drain Current | 40 | A |
| $V_{GS}$ | Gate-to-Source Voltage | $\pm 20$ | V |
| $E_{AS}$ [a2] | Single Pulse Avalanche Energy | 84 | mJ |
| $P_D$ | Power Dissipation | 2.9 | W |
| | Derating Factor above 25 ℃ | 0.0232 | W/℃ |
| $T_J$，$T_{stg}$ | Operating Junction and Storage Temperature Range | 150，−55 to 150 | ℃ |

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

| OFF Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $V_{DSS}$ | Drain to Source Breakdown Voltage | $V_{GS}$=0V, $I_D$=250μA | 45 | -- | -- | V |
| $I_{DSS}$ | Drain to Source Leakage Current | $V_{DS}$ = 45V, $V_{GS}$= 0V, $T_J$ = 25℃ | -- | -- | 1 | μA |
| | | $V_{DS}$ =36V, $V_{GS}$= 0V, $T_J$ = 125℃ | -- | -- | 100 | |
| $I_{GSS(F)}$ | Gate to Source Forward Leakage | $V_{GS}$ =+20V | -- | -- | 100 | nA |
| $I_{GSS(R)}$ | Gate to Source Reverse Leakage | $V_{GS}$ =-20V | -- | -- | -100 | nA |

| ON Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $R_{DS(ON)}$ | Drain-to-Source On-Resistance | $V_{GS}$=10V,$I_D$=10A | -- | 10 | 14 | mΩ |
| | | $V_{GS}$=4.5V,$I_D$=8A | -- | 12.5 | 18 | mΩ |
| $V_{GS(TH)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | 1.0 | 1.5 | 2.0 | V |
| Pulse width tp≤300μs, δ ≤2% | | | | | | |

| Dynamic Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | -- | 2.4 | -- | Ω |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V $V_{DS}$ = 20V f = 1.0MHz | -- | 1477 | -- | pF |
| $C_{oss}$ | Output Capacitance | | -- | 132 | -- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 115 | -- | |

| Resistive Switching Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $t_{d(ON)}$ | Turn-on Delay Time | $V_{DD}$=20 V, $R_L$= 1Ω $V_G$=10 V, $R_G$= 3Ω | -- | 10.2 | -- | ns |
| tr | Rise Time | | -- | 7.9 | -- | |
| $t_{d(OFF)}$ | Turn-Off Delay Time | | -- | 40.2 | -- | |
| $t_f$ | Fall Time | | -- | 5.4 | -- | |
| $Q_g$ | Total Gate Charge | $V_{GS}$=10V,$V_{DD}$=20V, $I_D$=10A | -- | 29.55 | -- | nC |
| $Q_{gs}$ | Gate to Source Charge | | -- | 4.1 | -- | |
| $Q_{gd}$ | Gate to Drain ("Miller")Charge | | -- | 6.85 | -- | |

| Source-Drain Diode Characteristics |
|---|

| Symbol | Parameter | Test Conditions | Rating | | | Units |
|--------|-----------|-----------------|--------|--------|--------|-------|
| | | | Min. | Typ. | Max. | |
| $I_S$ | Continuous Source Current (Body Diode) | $T_C = 25℃$ | -- | -- | 10 | A |
| $I_{SM}$ | Maximum Pulsed Current (Body Diode) | | -- | -- | 40 | A |
| $V_{SD}$ | Diode Forward Voltage | $I_S=10A, V_{GS}=0V$ | -- | -- | 1.2 | V |
| trr | Reverse Recovery Time | di/dt=100A/us IF=20A | -- | 19.59 | -- | ns |
| Qrr | Reverse Recovery Charge | | -- | 9.89 | -- | nC |
| Pulse width tp≤300μs, δ≤2% | | | | | | |

| Symbol | Parameter | Max. | Units |
|--------|-----------|------|-------|
| $R_{\theta JA}$ | Junction-to-Ambient | 42 | ℃/W |

**Notes：**

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

[a2]：L=0.5mH, $I_D$=18.3A, Start $T_J$=25℃

[a3]：Recommend soldering temperature defined by IPC/JEDEC J-STD 020

## Characteristics Curve：
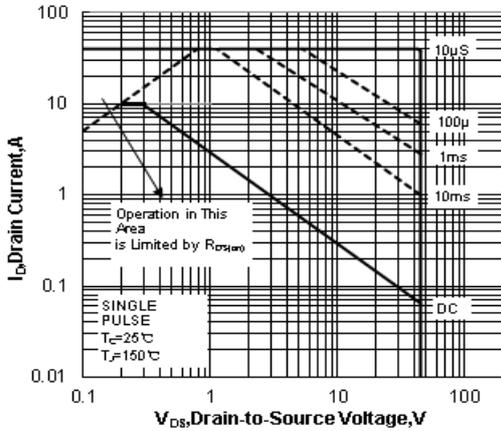
Figure 1 . Maximum Safe Operating Area
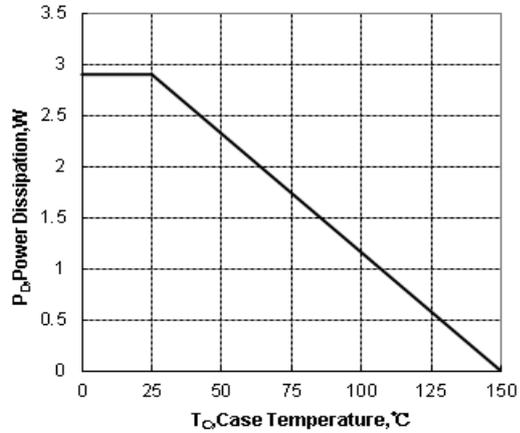
Figure 2. Maximum Power Dissipation vs Case Temperature
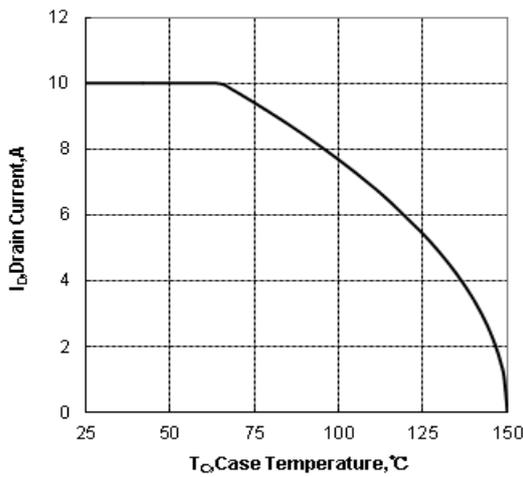
Figure 3. Maximum Continuous Drain Current vs Case Temperature
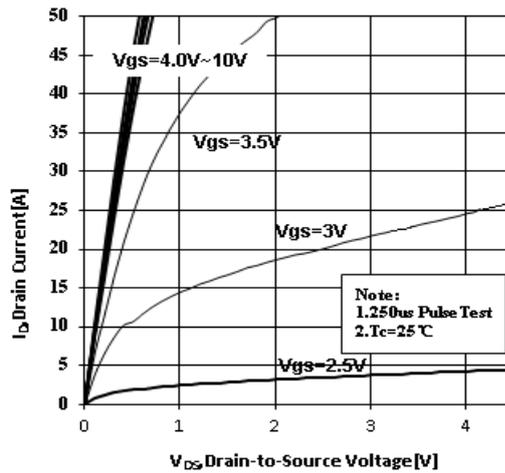
Figure 4. Typical output Characteristics
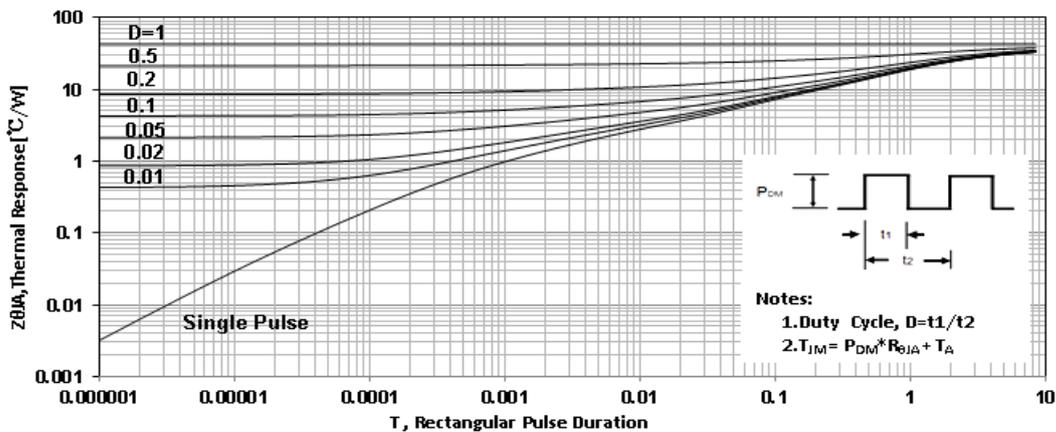
Figure 5 Maximum Effective Thermal Impedance , Junction to Ambient
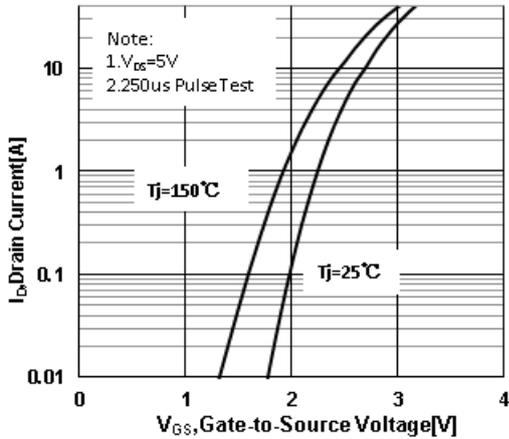
Figure 6 Typical Transfer Characteristics
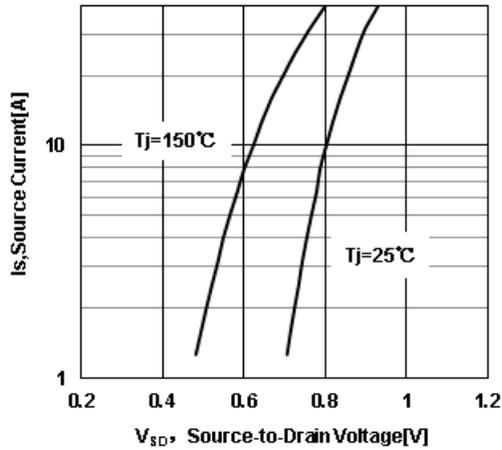


Figure 7 Typical Body Diode Transfer Characteristics
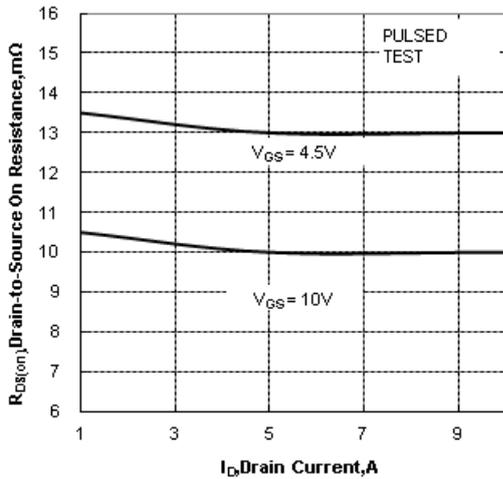


Figure 8. Drain-to-Source On Resistance vs Drain Current
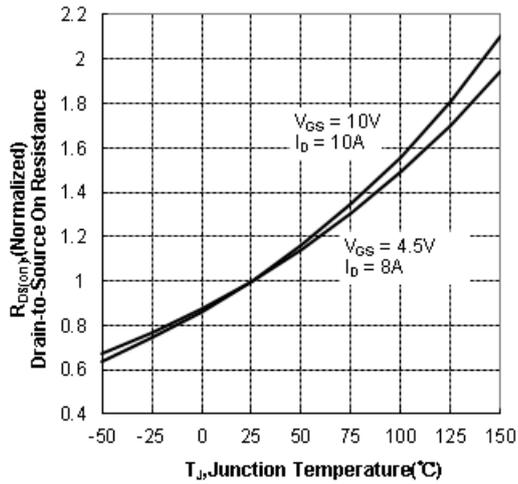


Figure 9. Normalized On Resistance vs Junction Temperature
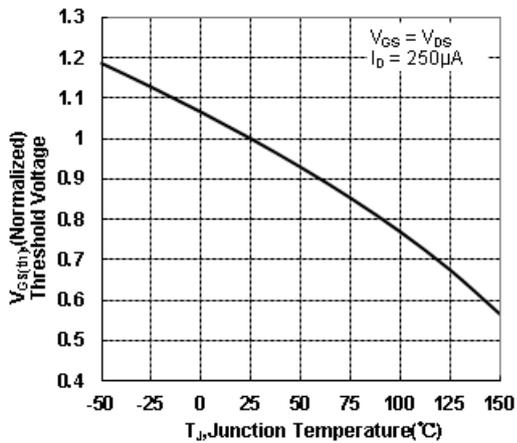


Figure 10. Normalized Threshold Voltage vs Junction Temperature
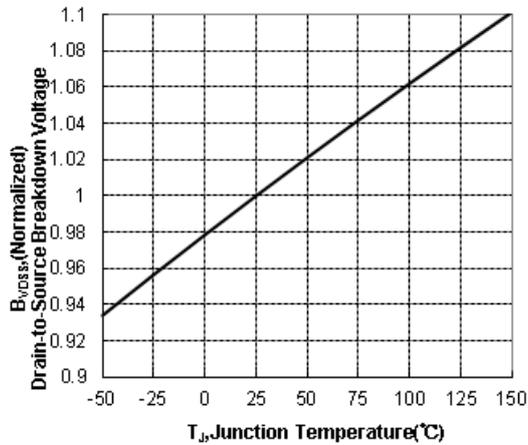


Figure 11. Normalized Breakdown Voltage vs Junction Temperature
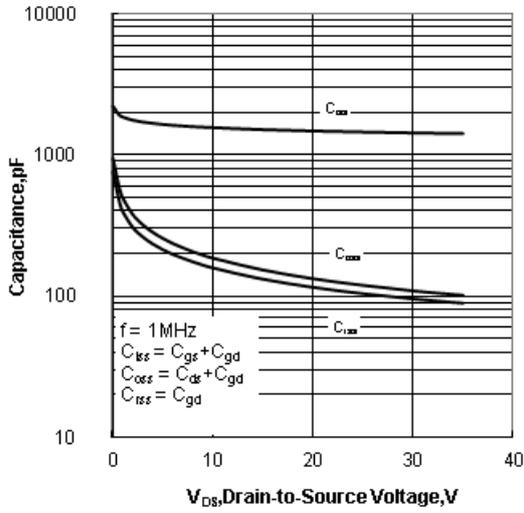
Figure 12. Capacitance
Characteristics
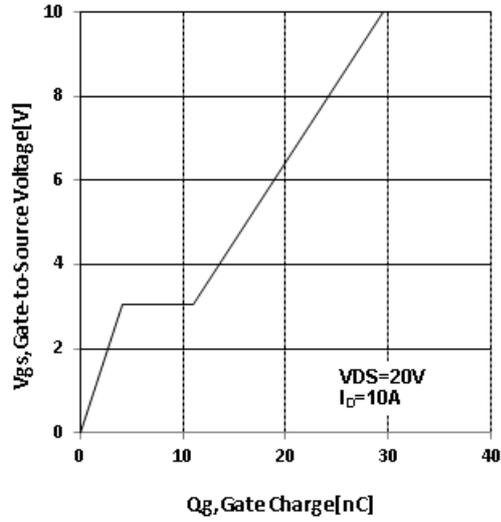


Figure 13  Typical Gate Charge vs Gate
to Source Voltage
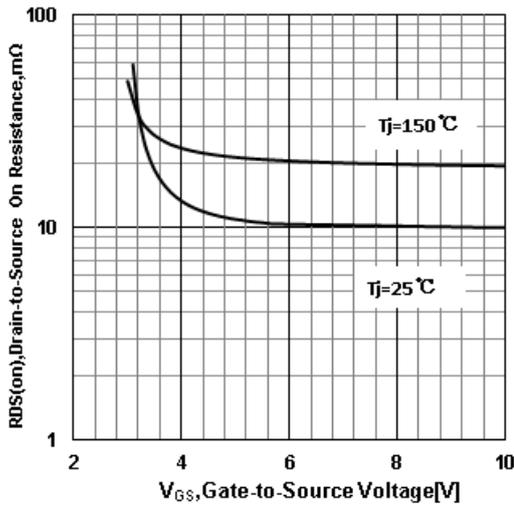


Figure  14  . Drain-to-Source On Resistance
vs Gate Voltage

## Test Circuit and Waveform:
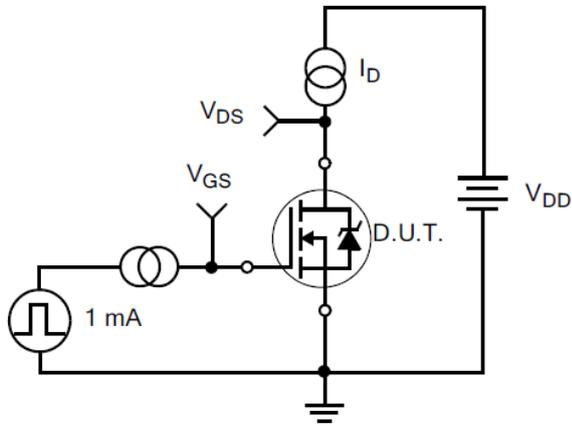
Figure 14. Gate Charge Test Circuit
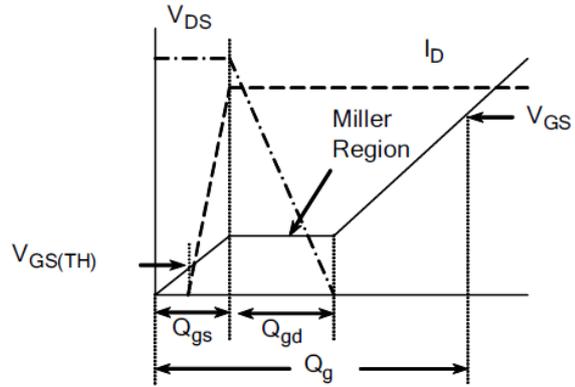
Figure 15. Gate Charge Waveforms
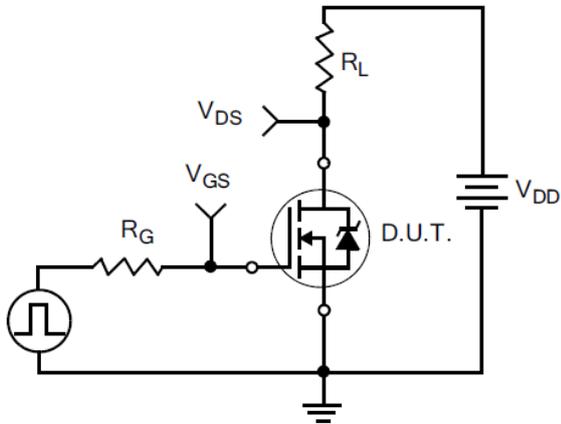
Figure 16. Resistive Switching Test Circuit
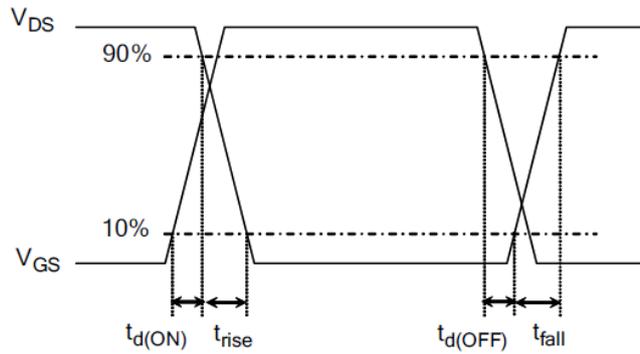
Figure 17. Resistive Switching Waveforms
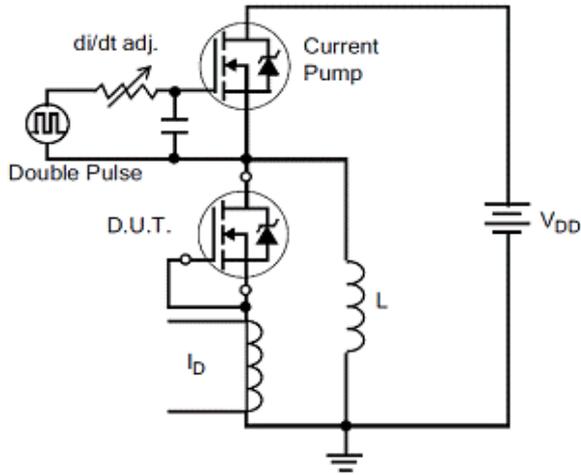
Figure 18. Diode Reverse Recovery Test Circuit
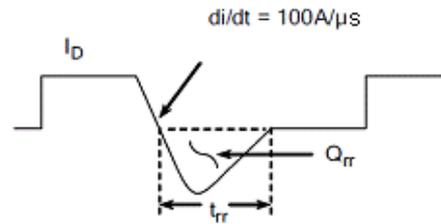
Figure 19. Diode Reverse Recovery Waveform
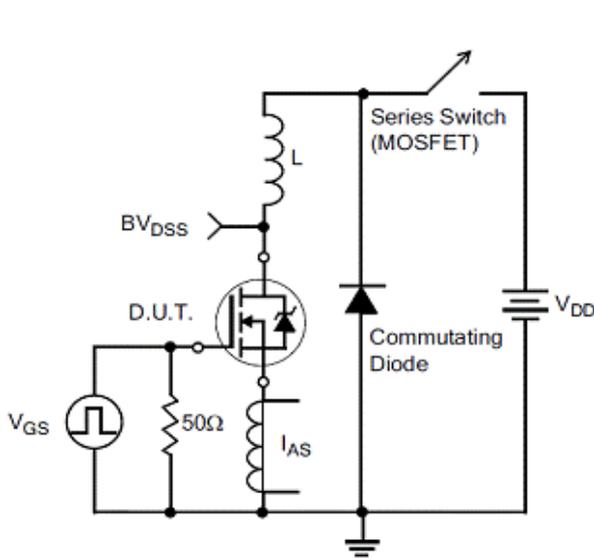
Figure20.Unclamped Inductive Switching Test Circuit
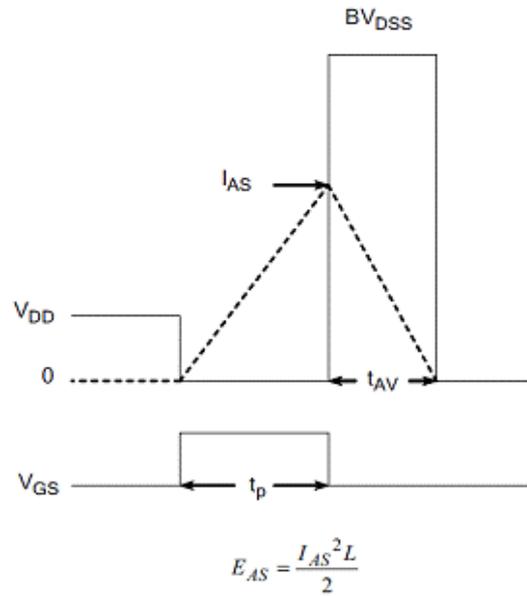
Figure21.Unclamped Inductive Switching Waveform

$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

## Package Information：
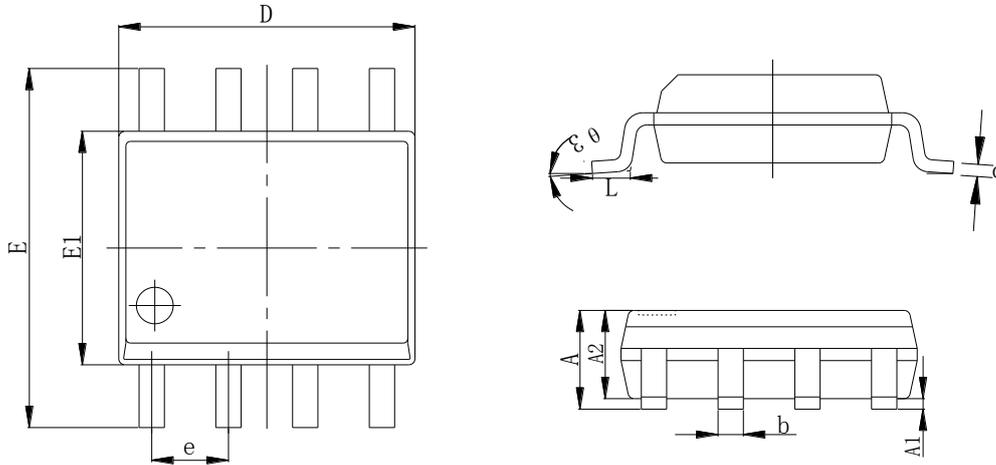


| Items | Values(mm) | |
|---|---|---|
| | MIN | MAX |
| A | 1.30 | 1.80 |
| A1 | 0.10 | 0.25 |
| A2 | 1.30 | 1.50 |
| E | 5.80 | 6.20 |
| E1 | 3.80 | 4.00 |
| D | 4.80 | 5.00 |
| L | 0.40 | 0.90 |
| e | 1.27 TYP | |
| b | 0.37 | 0.47 |
| c | 0.20 TYP | |
| θ3 | 0° | 8° |

SOP8 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. ×：Means the hazardous material exceeds the criterion of 2011/65/EU. 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 heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.

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.