# Silicon N-Channel Power MOSFET

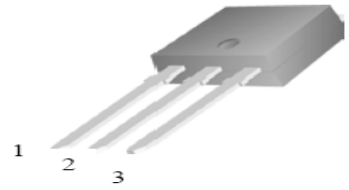
## CS90N03 A3

## General Description：

CS90N03 A3, 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. This device is suitable for use as a load switch and PWM applications. The package form is TO-251, which accords with the RoHS standard.

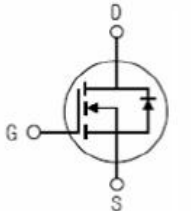
| | | |
|---|---|---|
| $V_{DSS}$ | 30 | V |
| $I_D$（Silicon limited current） | 90 | A |
| $I_D$（Package limited） | 60 | A |
| $P_D$ | 53 | W |
| $R_{DS(ON)Typ}$ | 3.6 | mΩ |

TO-251



1.Gate 2.Drain 3.Source

Inner Equivalent Principium Chart




## Features：

- **Fast Switching**
- **Low ON Resistance**(**Rdson≤5.5 mΩ**)
- **Low Gate Charge**
- **Low Reverse transfer capacitances**
- **100% Single Pulse avalanche energy Test**

## Applications：

Power switch circuit of adaptor and charger.

**Absolute**（$T_j$= 25℃ unless otherwise specified）

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-to-Source Voltage | 30 | V |
| $I_D$ | Continuous Drain Current $T_C$ =25 °C | 90 | A |
| | Continuous Drain Current $T_C$ = 100 °C | 60 | A |
| $I_{DM}$[a1] | Pulsed Drain Current $T_C$ = 25 °C | 360 | A |
| $V_{GS}$ | Gate-to-Source Voltage | ±20 | V |
| $E_{AS}$[a2] | Avalanche Energy | 240 | mJ |
| $P_D$ | Power Dissipation $T_C$ = 25 °C | 53 | W |
| | Derating Factor above 25°C | 0.424 | W/℃ |
| $T_J$， $T_{stg}$ | Operating Junction and Storage Temperature Range | 150，–55 to 150 | ℃ |
| $T_L$ | MaximumTemperature for Soldering | 300 | ℃ |

**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 | 30 | -- | -- | V |
| $I_{DSS}$ | Drain to Source Leakage Current | $V_{DS}$ =30V, $V_{GS}$= 0V, $T_j$ = 25℃ | -- | -- | 1 | μA |
| | | $V_{DS}$ =24V, $V_{GS}$= 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,$I_D$=19A | -- | 3.6 | 5.5 | mΩ |
| | | $V_{GS}$=4.5V,$I_D$=19A | -- | 5.0 | 7.5 | 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 | -- | 2.2 | -- | Ω |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V $V_{DS}$ =15V f = 1.0MHz | -- | 2848 | -- | pF |
| $C_{oss}$ | Output Capacitance | | -- | 356 | -- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 316 | -- | |

| **Resistive Switching Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $t_{d(ON)}$ | Turn-on Delay Time | $V_{GS}$=10V， $R_G$=3Ω $V_{DD}$=15V， $I_D$=45A | -- | 13 | -- | ns |
| tr | Rise Time | | -- | 8 | -- | |
| $t_{d(OFF)}$ | Turn-Off Delay Time | | -- | 56.5 | -- | |
| $t_f$ | Fall Time | | -- | 12 | -- | |
| $Q_g$ | Total Gate Charge | $I_D$ =45A $V_{DD}$ =15V $V_{GS}$ = 10V | -- | 53.5 | -- | nC |
| $Q_{gs}$ | Gate to Source Charge | | -- | 8.2 | -- | |
| $Q_{gd}$ | Gate to Drain (“Miller”)Charge | | -- | 12 | -- | |

| Source-Drain Diode Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $I_S$ | Continuous Source Current (Body Diode) | $T_C$ = 25 °C | -- | -- | 90 | A |
| $I_{SM}$ | Maximum Pulsed Current (Body Diode) | | -- | -- | 360 | A |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=45A,$V_{GS}$=0V | -- | -- | 1.2 | V |
| trr | Reverse Recovery Time | di/dt=100A/us IF=45A | -- | 12 | -- | ns |
| Qrr | Reverse Recovery Charge | | -- | 4.2 | -- | nC |
| Pulse width tp≤300μs, δ ≤2% | | | | | | |

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | 2.36 | ℃/W |
| $R_{\theta JA}$ | Junction-to-Ambient | 100 | ℃/W |

[a1]: Repetitive rating; pulse width limited by maximum junction temperature
[a2]: L=0.5mH,Ias=31A Start $T_J$=25℃

## Characteristics Curve：

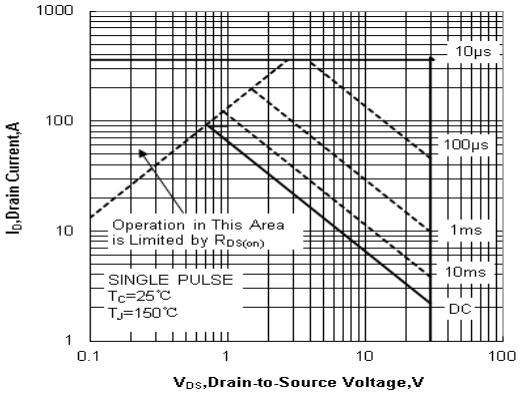



**Figure 1. Maximum Safe Operating**

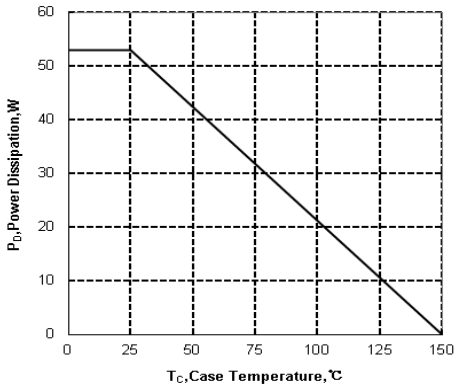



**Figure 2. Maximum Power Dissipation vs Case Temperature**

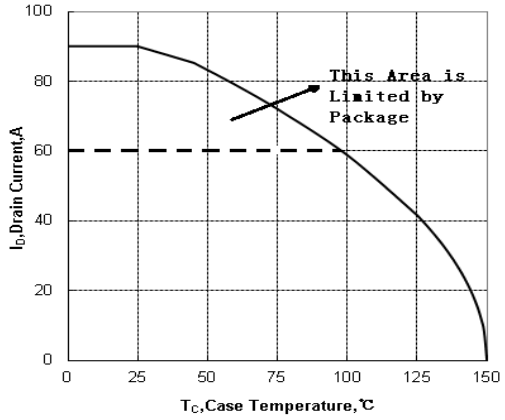



**Figure3. Maximum Continuous Drain Current vs Case Temperature**

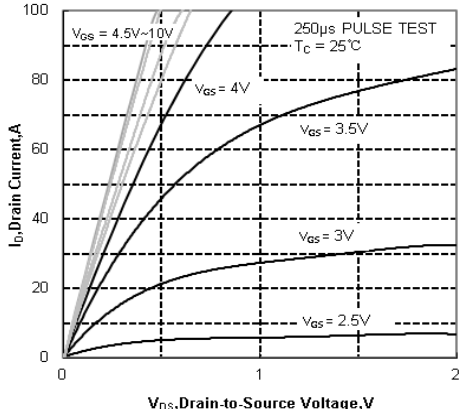



**Figure4. Typical Output Characteristics**

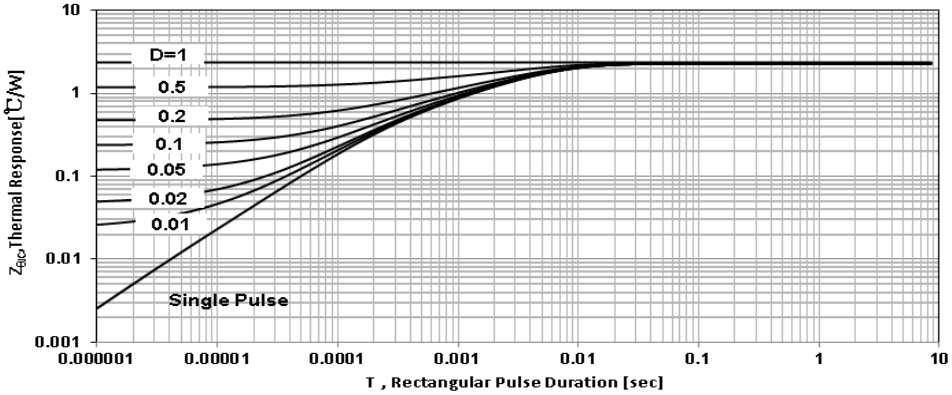



**Figure 5. Maximum Effective Transient Thermal Impedance, Junction-to-Case**

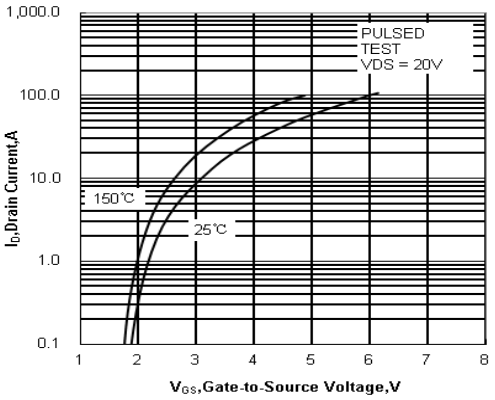



**Figure 6. Typical Transfer Characteristics**

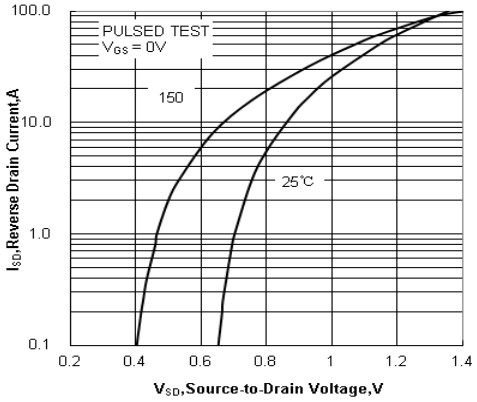



**Figure 7. Typical Body Diode Transfer Characteristics**

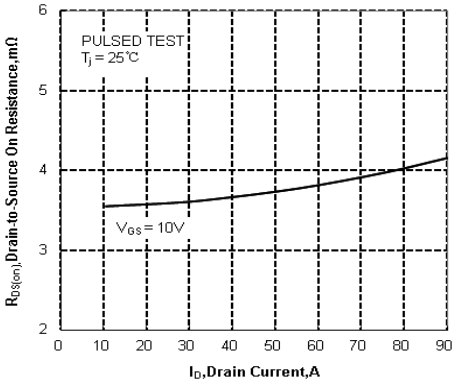



**Figure 8. Drain-to-Source On Resistance vs Drain Current**

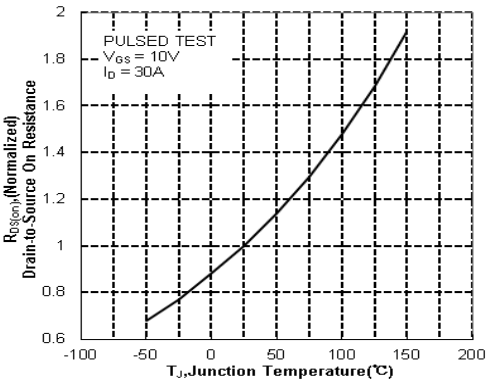



**Figure 9. Typical Drian to Source on Resistance vs Junction Temperature**

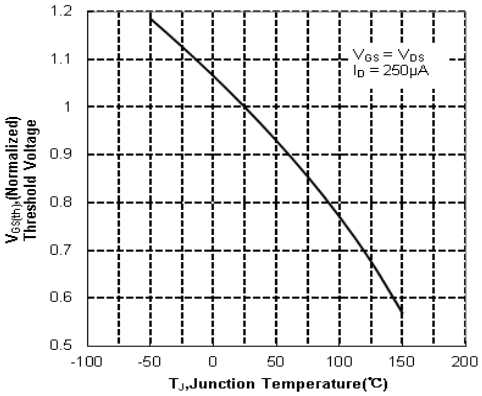



**Figure 10. Typical Theshold Voltage vs Junction Temperature**

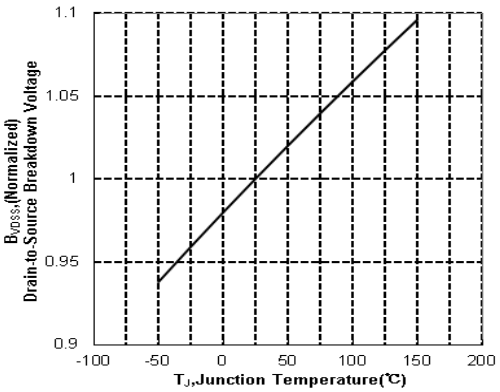



**Figure 11. Typical Breakdown Voltage vs Junction Temperature**

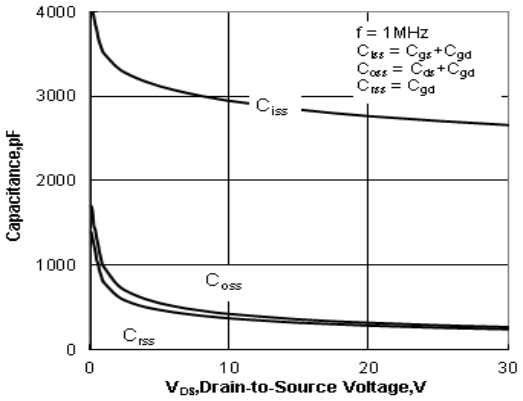



**Figure 12. Typical Capacitance vs Drain to Source Voltage**

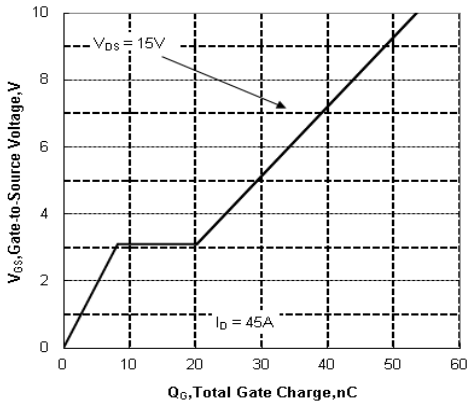



**Figure13. Typical Gate Charge vs Gate to Source Voltage**

## Test Circuit and Waveform

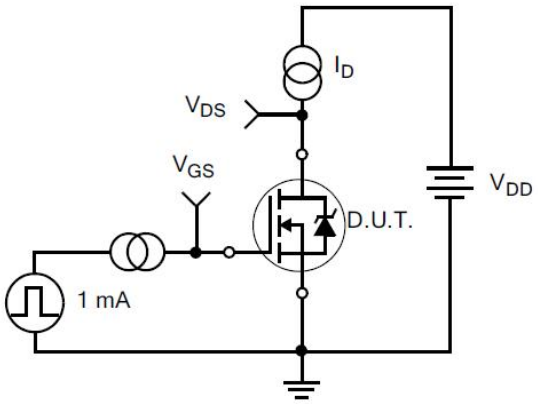



Figure 14. Gate Charge Test Circuit

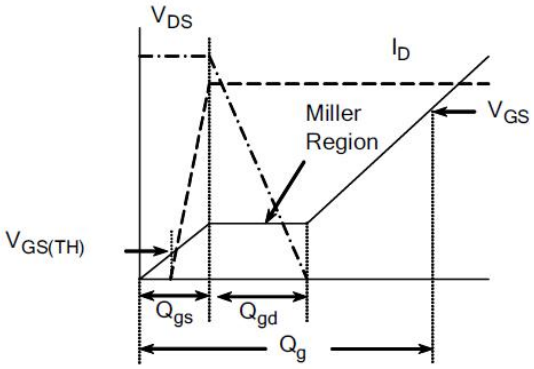



Figure 15. Gate Charge Waveforms

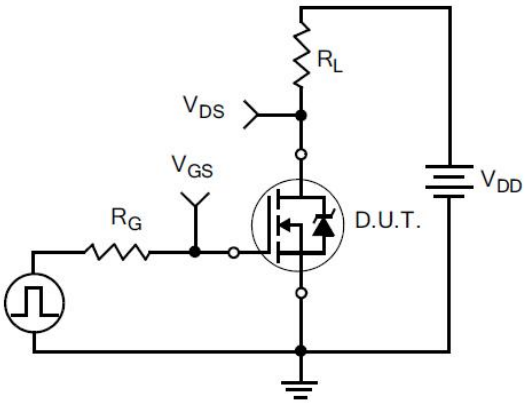



Figure 16. Resistive Switching Test Circuit

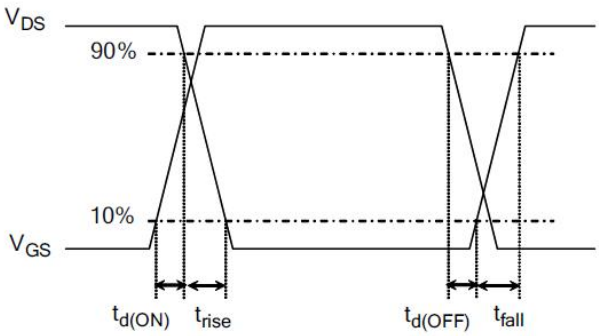



Figure 17. Resistive Switching Waveforms

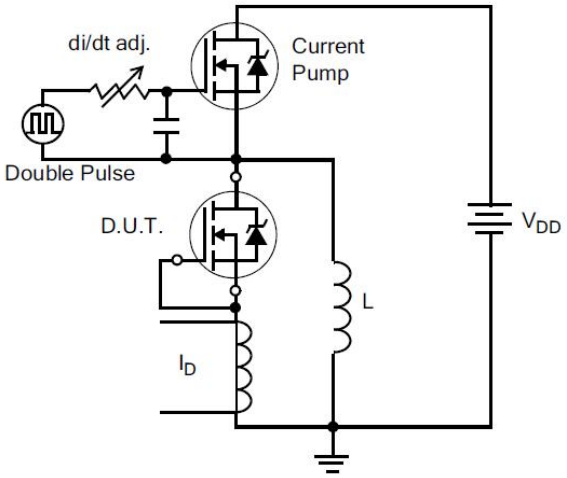



Figure 18. Diode Reverse Recovery Test Circuit

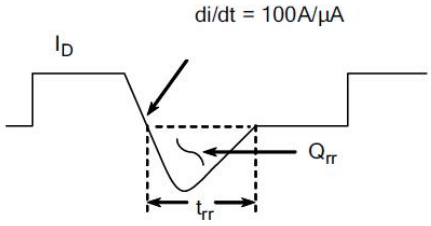



Figure 19. Diode Reverse Recovery Waveform

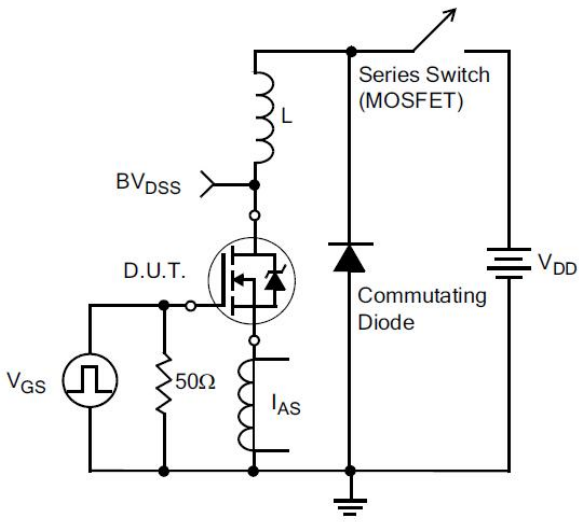



Figure20.Unclamped Inductive Switching Test Circuit

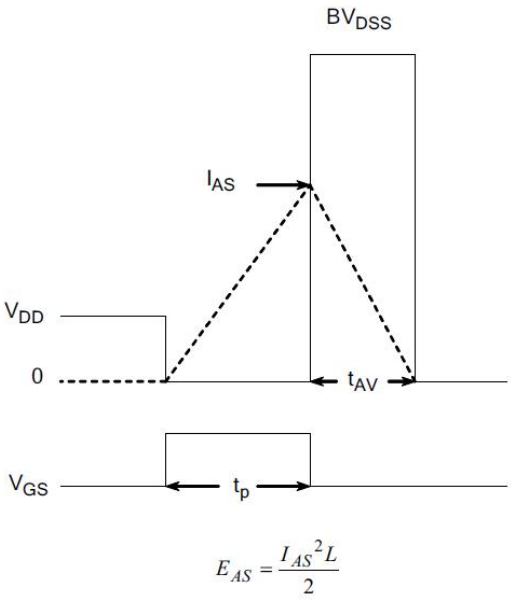
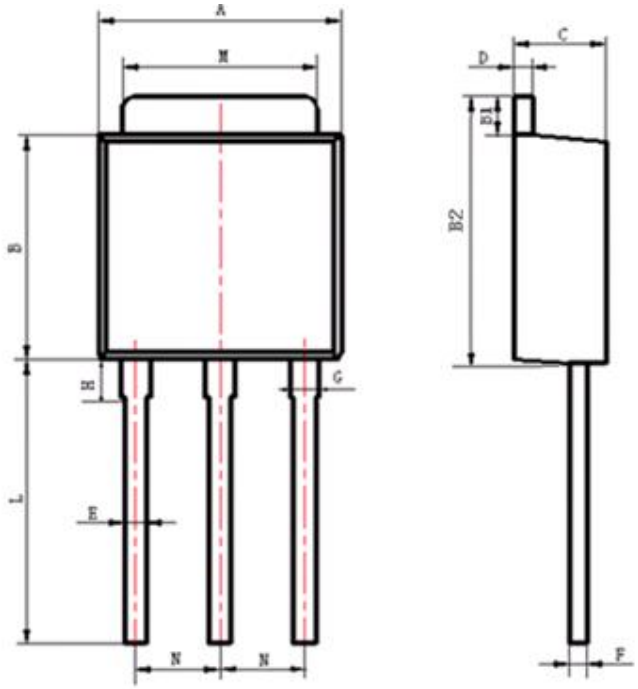



Figure21.Unclamped Inductive Switching Waveform

## Package Information：




| Items | Values(mm) | |
|---|---|---|
| | MIN | MAX |
| A | 6.30 | 6.90 |
| B | 5.20 | 6.30 |
| B1 | 0.70 | 1.30 |
| B2 | 6.80 | 7.40 |
| C | 2.10 | 2.50 |
| D | 0.30 | 0.60 |
| E | 0.50 | 0.86 |
| F | 0.30 | 0.60 |
| G | 0.70 | 1.00 |
| H | 1.40 | 2.40 |
| L* | 9.00 | 9.80 |
| M | 5.10 | 5.50 |
| N | 2.09 | 2.49 |

*adjustable

TO-251 Package

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

| | 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 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Solder | × | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 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.

**WUXI CHINA RESOURCES HUAJING MICROELECTRONICS CO., LTD.**

**Add： No.14 Liangxi RD. Wuxi, Jiangsu, China Mail:214061 http://www. crhj.com.cn**
**Tel: +86 0510-85807228 Fax: +86- 0510-85800864**

**Marketing Part： Post：214061 Tel： +86 0510-81805277/81805336**
**Fax: +86 0510-85800360/85803016**

**Application and Service：Post：214061 Tel / Fax：+86- 0510-81805243/81805110**