# VSTD065R44ANA

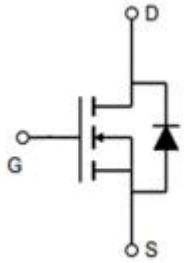
# Datasheet

# 440mΩ, 650V, N-Channel Power MOSFET VSTD065R44ANA

## General Description

| $V_{(BR)DSS}$ | $R_{DS(ON)\_max}$ | $I_D$ |
|---|---|---|
| 650V | 440mΩ@10V | 10A |

## Symbol

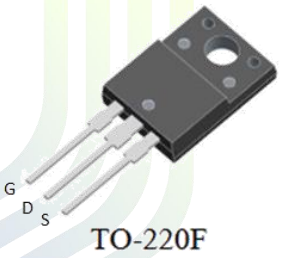



Symbol of VSTD065R44ANA

## Features

- Extremely low switching loss
- Excellent stability and uniformity
- RoHS and Halogen-Free Compliant

## Package Type




Package Type of VSTD065R44ANA

## Application

- PC power
- LED lighting
- Telecom power
- Server power
- Solar/UPS

## Ordering Information

| Product Name | Package | Marking |
|---|---|---|
| VSTD065R44ANA | TO-220F | STD065R44ANA |

## Absolute Maximum Ratings

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 650 | V |
| Gate-Source Voltage | $V_{GS}$ | ±30 | V |
| Continuous Drain Current Note 1, $T_C$=25ºC | $I_D$ | 10 | A |
| Pulsed Drain Current Note 2, $T_C$=25ºC | $I_{D,\ pulse}$ | 30 | A |
| Continuous Diode Forward Current Note 1, $T_C$=25ºC | $I_S$ | 10 | A |
| Diode Pulsed Current Note 2, $T_C$=25ºC | $I_{S,\ pulse}$ | 30 | A |
| Max Power Dissipation Note 3, $T_C$=25ºC | $P_D$ | 77 | W |
| Avalanche Current, Single Pulse Note 4 | $I_{AS}$ | 5.6 | A |
| Avalanche Energy, Single Pulse Note4 | $E_{AS}$ | 317.3 | mJ |
| MOSFET dv/dt ruggedness, $V_{DS}$=0~480V | dv/dt | 50 | V/ns |
| Reverse diode dv/dt, $V_{DS}$=0~480V, $I_{SD}$<= $I_D$ | dv/dt | 15 | V/ns |
| Operation and storage temperature | $T_J$,$T_{STG}$ | -55 to 150 | ºC |

## Thermal Resistance

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | | 1.63 | | ºC/W |
| Thermal Resistance, Junction-to-Ambient Note5 | $R_{\theta JA}$ | | 62 | | |

## Notes:

Note1: Calculated continuous current based on maximum allowable junction temperature.

Note2: Pulse width limited by safe operating area.

Note3: Based on max. junction temperature, using junction-case thermal resistance.

Note4: $V_{DD}$=50V, $V_{GS}$=10V, L=20mH, starting $T_A$=25 °C.

Note5: When mounted on 1 inch square copper board, t≤10sec. The value in any given application depends on the user's specific board design.

## Electrical Characteristics ($T_A$= 25 ºC, unless otherwise specified)

| Parameter | | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Statistic Characteristics** | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $V_{GS}$=0V, $I_D$=250uA | 650 | | | V |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$=650V, $V_{GS}$=0V | | | 1 | uA |
| Gate-Source Leakage Current | Forward | $I_{GSSF}$ | $V_{GS}$=30V, $V_{DS}$=0V | | | 100 | nA |
| | Reverse | $I_{GSSR}$ | $V_{GS}$=-30V, $V_{DS}$=0V | | | -100 | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250uA | 2.9 | | 3.9 | V |
| Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=5A | | 395 | 440 | mΩ |
| Gate Resistance | | $R_G$ | F=1MHz, Open Drain | | 5.48 | | Ω |
| **Dynamic Characteristics** | | | | | | | |
| Input Capacitance | | $C_{iss}$ | $V_{DS}$=100V | | 688.5 | | pF |
| Output Capacitance | | $C_{oss}$ | $V_{GS}$=0V | | 57.44 | | pF |
| Reverse Transfer Capacitance | | $C_{rss}$ | f=1MHz | | 1.4 | | pF |
| Turn-on Delay Time | | $t_{d(on)}$ | $V_{DS}$=400V | | 16.3 | | ns |
| Rise Time | | $t_r$ | $I_D$=5A | | 11.9 | | |
| Turn-off Delay Time | | $t_{d(off)}$ | $R_G$=25Ω | | 54.2 | | |
| Fall Time | | $t_f$ | $V_{GS}$=10V | | 8.7 | | |
| **Gate Charge Characteristics** | | | | | | | |
| Gate to Source Charge | | $Q_{gs}$ | $V_{DS}$=400V | | 4.6 | | nC |
| Gate to Drain Charge | | $Q_{gd}$ | $I_D$=5A | | 5.7 | | |
| Gate Charge Total | | $Q_g$ | $V_{GS}$=0 to 10V | | 14.2 | | |
| Gate Plateau Voltage | | $V_{Plateau}$ | | | 5.45 | | V |
| **Reverse Diode Characteristics** | | | | | | | |
| Drain-Source Diode Forward Voltage | | $V_{SD}$ | $V_{GS}$=0V, $I_S$=1A | | 0.74 | | V |
| Reverse Recovery Time | | $t_{rr}$ | $V_R$=400V | | 272.4 | | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | $I_S$=5A | | 2.2 | | uC |
| Peak Reverse Recovery Current | | $I_{rrm}$ | di/dt=100A/us | | 16.3 | | A |

# Electrical Characteristics Diagrams

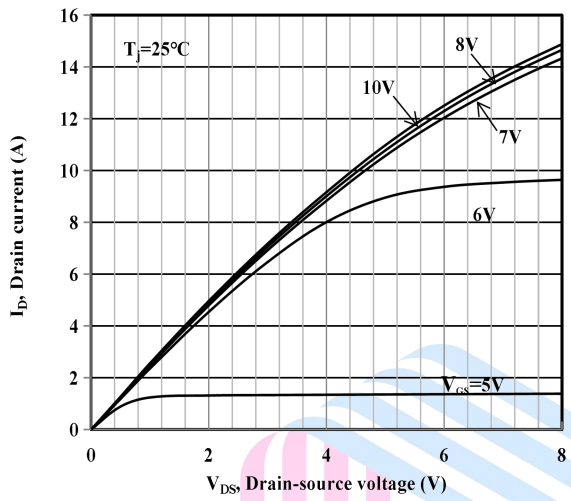



Figure 1. Typ. output characteristics

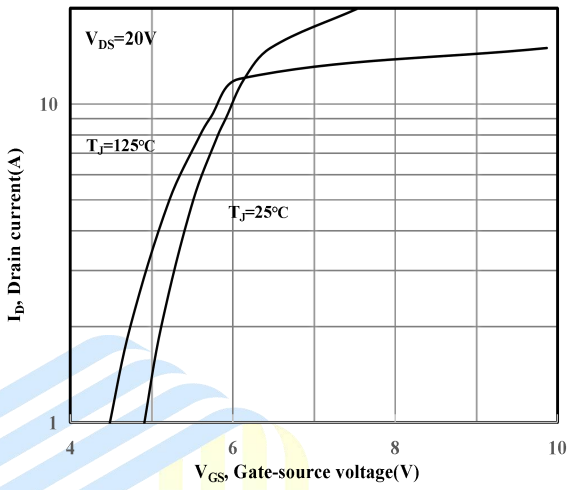



Figure 2. Typ. transfer characteristics

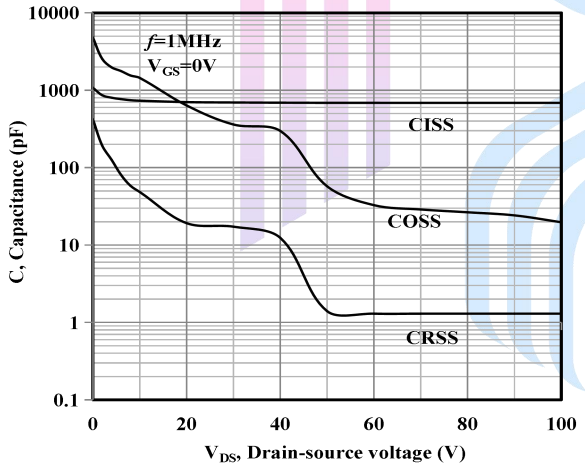



Figure 3. Typ. Capacitances

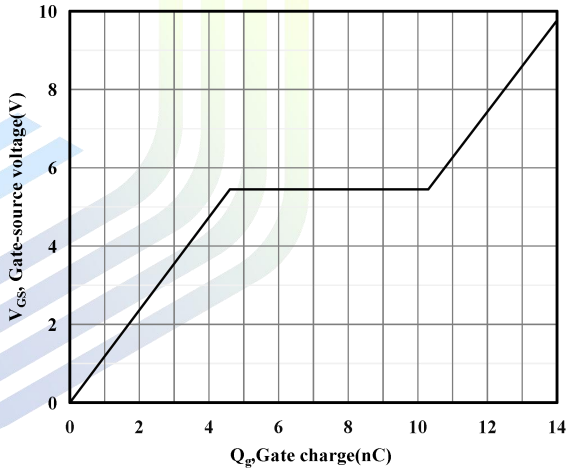



Figure 4. Typ. gate charge

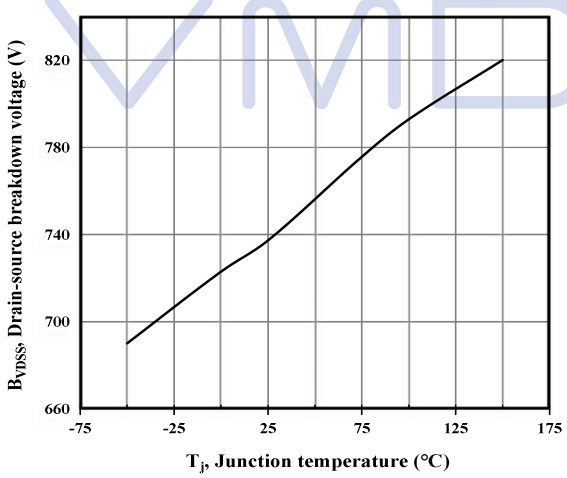



Figure 5. Drain-source breakdown voltage

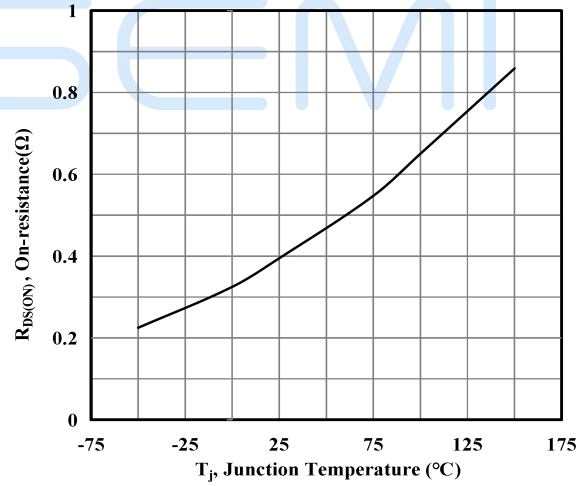



Figure 6. Drain-source on-state resistance

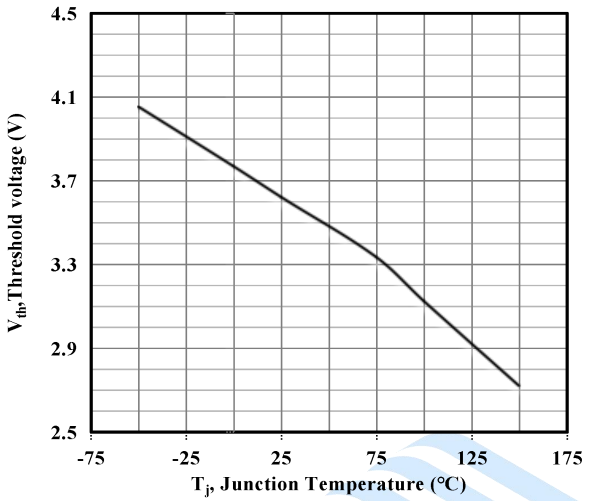



Figure 7. Threshold voltage

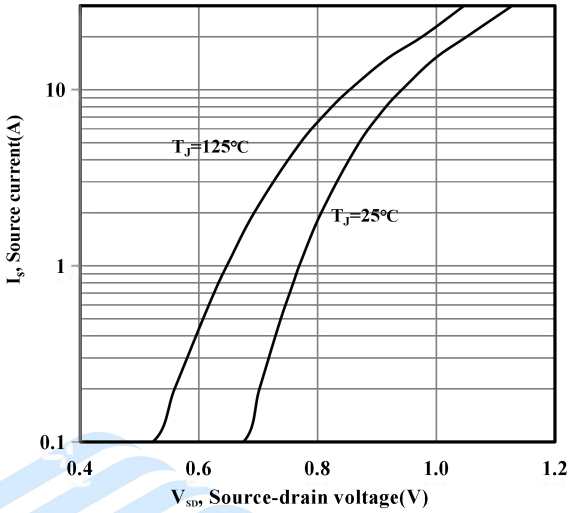



Figure 8. Forward characteristic of body diode

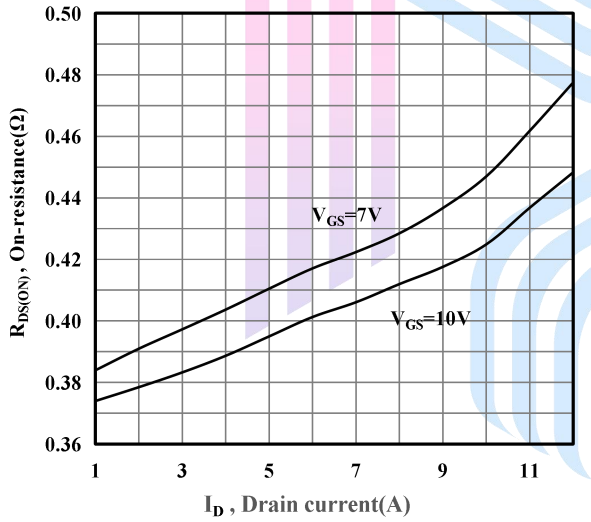



Figure 9. Drain-source on-state resistance

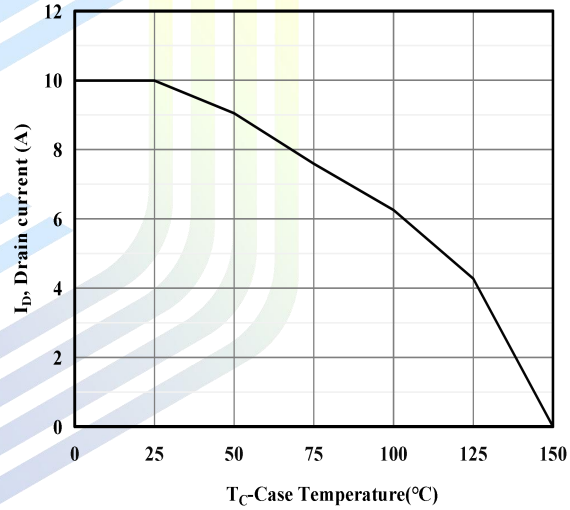



Figure 10. Drain current Derating

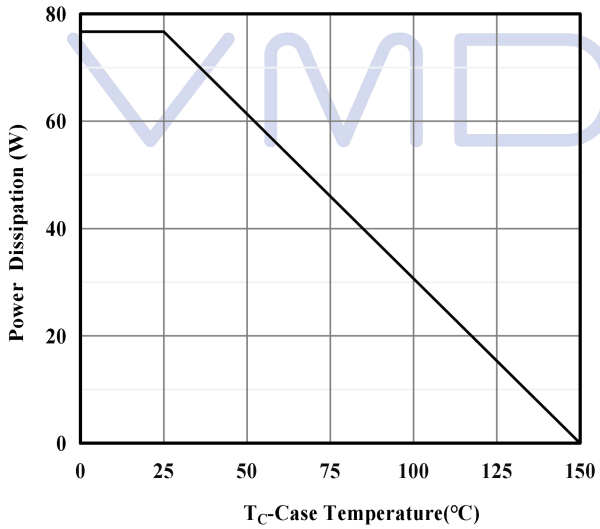



Figure 11. Power Dissipation

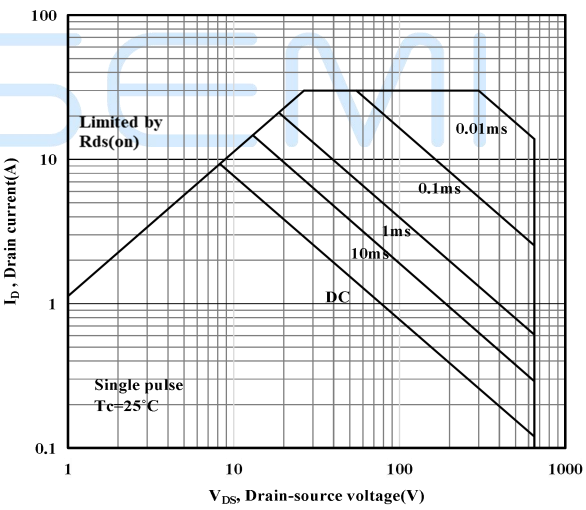



Figure 12. Safe operation area $T_C$=25℃

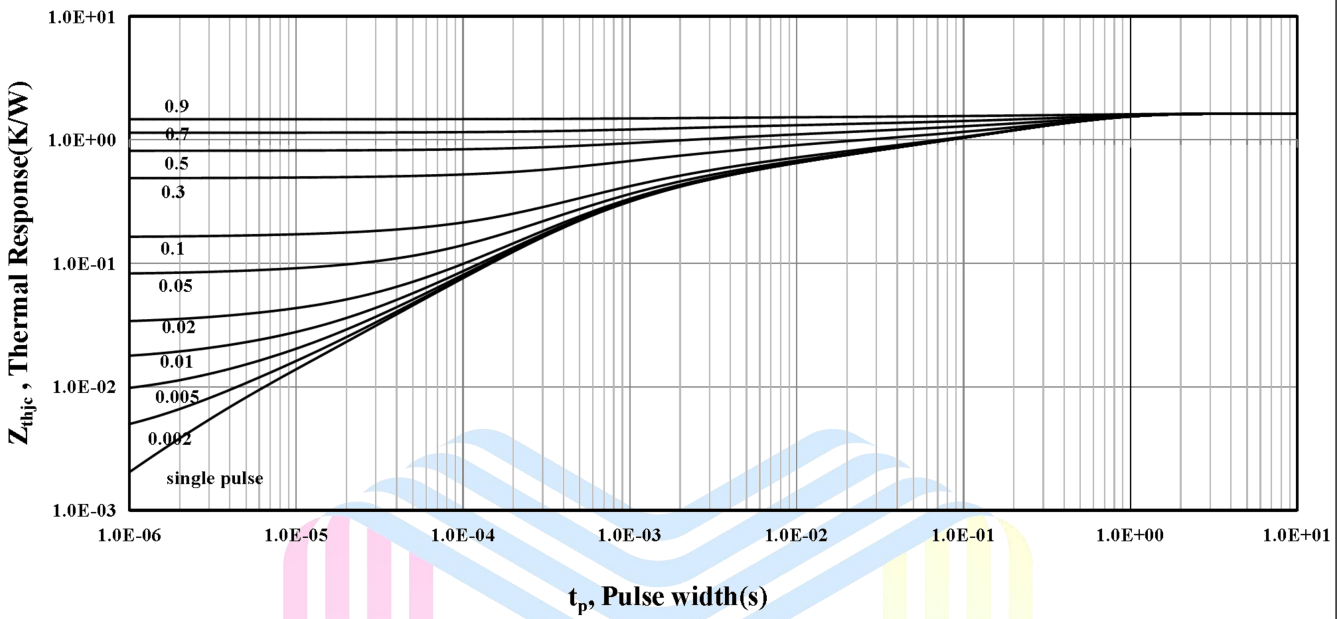
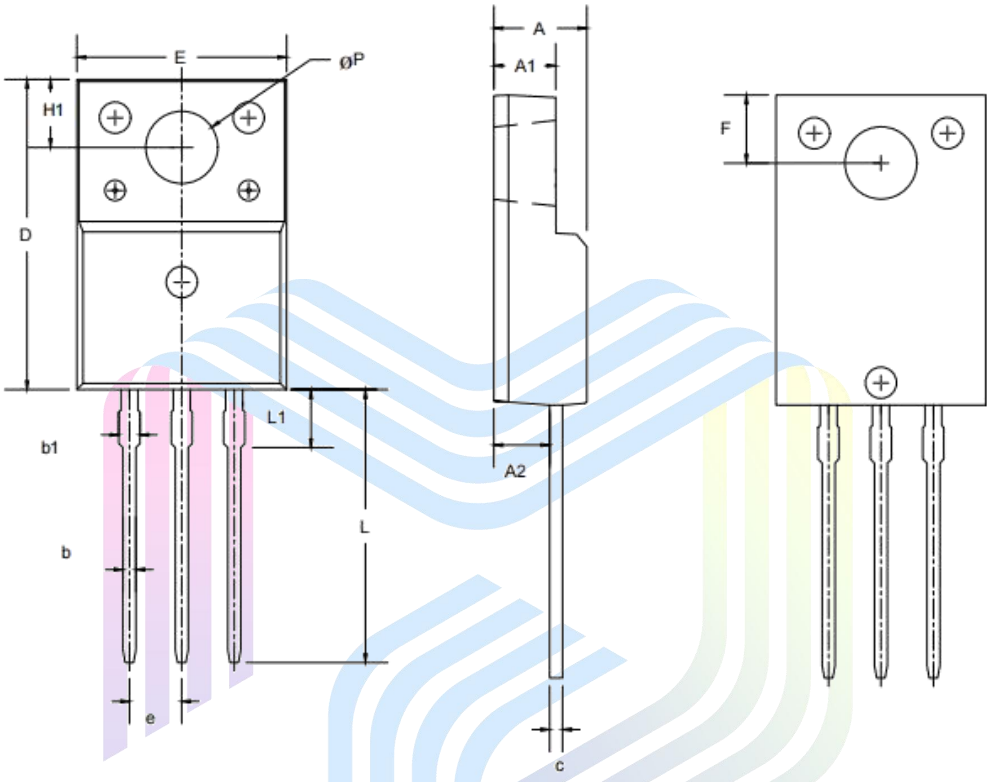



**Figure 13. Max. transient thermal impedance**

# Mechanical Dimensions

**TO-220F Package Information**




| SYMBOL | MIN | MAX |
|---|---|---|
| A | 4.50 | 4.90 |
| A1 | 2.30 | 2.80 |
| A2 | 2.50 | 2.90 |
| b | 0.70 | 0.95 |
| b1 | 1.08 | 1.55 |
| c | 0.40 | 0.70 |
| D | 15.00 | 16.17 |
| E | 9.50 | 10.50 |
| e | 2.54BSC | |
| F | 2.80 | 3.65 |
| H1 | 6.7REF | |
| L | 12.50 | 13.50 |
| L1 | 2.90 | 3.90 |
| ΦP | 2.90 | 3.40 |

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# Via-Media Semiconductor Limited Company

## http://www.vmdsemi.com

**Main Sites:**


- **Headquarters**

Hangzhou Via-Media Semiconductor Co., LTD.
1305-1306, Building 71, No. 90, Wensan Road, Xihu District, Hangzhou, Zhejiang Province, P.R. China
Tel: +86-0571-8515 0563

- **Chengdu Office**

Chengdu Winhi Semiconductor Co., LTD.
Floor 15, Building 5, No. 171, Hele 2nd Street, Chengdu, Sichuan Province, P.R. China
Tel: +86-028-8505 0771

- **Shanghai**

Shanghai R&D Center.
1506~1508, Xinyin Building, 888 Yishan Road, Shanghai, P.R of China

Tel: +86-021-54201999

- **Shenzhen**

Shenzhen Sales office .
Room 4A15, Block AB, Tianxiang Building, Chegongmiao, Futian District, Shenzhen, P.R of China
Tel: +86-0755-82570682

- **Xi'an**

Xi'an R&D Center
1703B, Building A, Greenland Center, Jinye Road, High-Tech Zone, Xi'an, Shaanxi, P.R of China