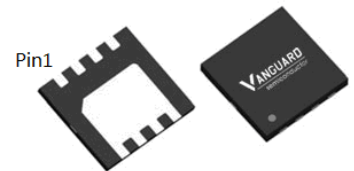


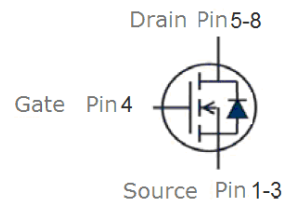
## Features

- N-Channel, 5V Logic Level Control
- Enhancement mode
- Very low on-resistance  $R_{DS(on)}$  @  $V_{GS}=4.5V$
- Fast Switching
- Pb-free lead plating; RoHS compliant

|                                |     |    |
|--------------------------------|-----|----|
| $V_{DS}$                       | 40  | V  |
| $R_{DS(on),TYP} @ V_{GS}=10V$  | 7.2 | mΩ |
| $R_{DS(on),TYP} @ V_{GS}=4.5V$ | 11  | mΩ |
| $I_D$                          | 53  | A  |

**TDFN3.3x3.3**


| Part ID  | Package Type | Marking | Tape and reel information |
|----------|--------------|---------|---------------------------|
| VS4610AB | TDFN3.3x3.3  | 4610AB  | 5000pcs/Reel              |



## Maximum ratings, at $T_J=25^\circ\text{C}$ , unless otherwise specified

| Symbol        | Parameter                               | Rating                        | Unit             |
|---------------|-----------------------------------------|-------------------------------|------------------|
| $V_{(BR)DSS}$ | Drain-Source breakdown voltage          | 40                            | V                |
| $I_S$         | Diode continuous forward current        | $T_C=25^\circ\text{C}$<br>53  | A                |
| $I_D$         | Continuous drain current @ $V_{GS}=10V$ | $T_C=25^\circ\text{C}$<br>53  | A                |
|               |                                         | $T_C=100^\circ\text{C}$<br>34 | A                |
| $I_{DM}$      | Pulse drain current tested ①            | $T_C=25^\circ\text{C}$<br>212 | A                |
| EAS           | Avalanche energy, single pulsed ②       | 40                            | mJ               |
| $P_D$         | Maximum power dissipation               | $T_C=25^\circ\text{C}$<br>33  | W                |
| $V_{GS}$      | Gate-Source voltage                     | $\pm 20$                      | V                |
| $T_{STG} T_J$ | Storage and operating temperature range | -55 to 150                    | $^\circ\text{C}$ |

## Thermal Characteristics

| Symbol          | Parameter                              | Typical | Unit               |
|-----------------|----------------------------------------|---------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance-Junction to Case    | 3.8     | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance-Junction to Ambient | 35      | $^\circ\text{C/W}$ |

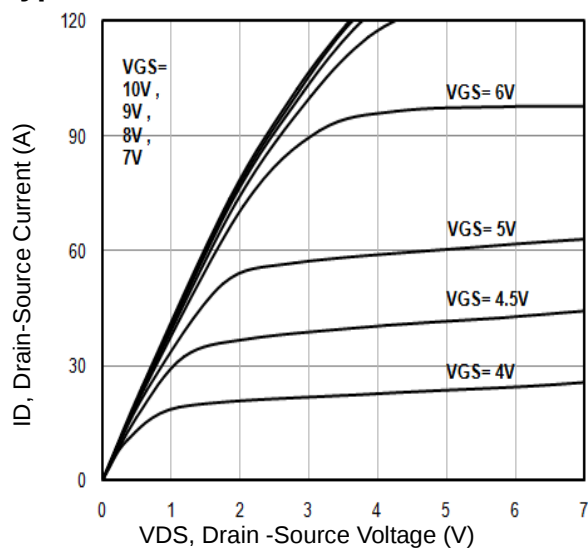
**Typical Characteristics**

| Symbol                                                                               | Parameter                                              | Condition                                                                                    | Min. | Typ. | Max. | Unit |
|--------------------------------------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------|------|------|------|------|
| Static Electrical Characteristics @ T <sub>c</sub> = 25°C (unless otherwise stated)  |                                                        |                                                                                              |      |      |      |      |
| 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(T <sub>c</sub> =25°C)  | V <sub>DS</sub> =40V,V <sub>GS</sub> =0V                                                     | --   | --   | 1    | μA   |
|                                                                                      | Zero Gate Voltage Drain Current(T <sub>c</sub> =125°C) | V <sub>DS</sub> =40V,V <sub>GS</sub> =0V                                                     | --   | --   | 100  | μA   |
| I <sub>GSS</sub>                                                                     | Gate-Body Leakage Current                              | V <sub>GS</sub> =±20V,V <sub>DS</sub> =0V                                                    | --   | --   | ±100 | nA   |
| V <sub>GS(TH)</sub>                                                                  | Gate Threshold Voltage                                 | V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA                                      | 1.3  | 1.7  | 2.4  | V    |
| R <sub>DS(ON)</sub>                                                                  | Drain-Source On-State Resistance③                      | V <sub>GS</sub> =10V, I <sub>D</sub> =15A                                                    | --   | 7.2  | 9.5  | mΩ   |
| R <sub>DS(ON)</sub>                                                                  | Drain-Source On-State Resistance③                      | V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A                                                   | --   | 11   | 14   | mΩ   |
| Dynamic Electrical Characteristics @ T <sub>c</sub> = 25°C (unless otherwise stated) |                                                        |                                                                                              |      |      |      |      |
| C <sub>iss</sub>                                                                     | Input Capacitance                                      | V <sub>DS</sub> =20V,V <sub>GS</sub> =0V,<br>f=1MHz                                          | 1700 | 2015 | 2300 | pF   |
| C <sub>oss</sub>                                                                     | Output Capacitance                                     |                                                                                              | 120  | 170  | 220  | pF   |
| C <sub>rss</sub>                                                                     | Reverse Transfer Capacitance                           |                                                                                              | 60   | 110  | 160  | pF   |
| R <sub>g</sub>                                                                       | Gate Resistance                                        |                                                                                              |      | 2.1  |      | Ω    |
| Q <sub>g</sub>                                                                       | Total Gate Charge                                      | V <sub>DS</sub> =20V,I <sub>D</sub> =15A,<br>V <sub>GS</sub> =10V                            | --   | 49.6 | --   | nC   |
| Q <sub>gs</sub>                                                                      | Gate-Source Charge                                     |                                                                                              | --   | 8    | --   | nC   |
| Q <sub>gd</sub>                                                                      | Gate-Drain Charge                                      |                                                                                              | --   | 16.4 | --   | nC   |
| Switching Characteristics                                                            |                                                        |                                                                                              |      |      |      |      |
| t <sub>d(on)</sub>                                                                   | Turn-on Delay Time                                     | V <sub>DD</sub> =20V,<br>I <sub>D</sub> =15A,<br>R <sub>G</sub> =3Ω,<br>V <sub>GS</sub> =10V | --   | 9.4  | --   | nS   |
| t <sub>r</sub>                                                                       | Turn-on Rise Time                                      |                                                                                              | --   | 7.1  | --   | nS   |
| t <sub>d(off)</sub>                                                                  | Turn-Off Delay Time                                    |                                                                                              | --   | 30.2 | --   | nS   |
| t <sub>f</sub>                                                                       | Turn-Off Fall Time                                     |                                                                                              | --   | 7.5  | --   | nS   |
| Source- Drain Diode Characteristics@ T <sub>c</sub> = 25°C (unless otherwise stated) |                                                        |                                                                                              |      |      |      |      |
| V <sub>SD</sub>                                                                      | Forward on voltage                                     | I <sub>SD</sub> =15A,V <sub>GS</sub> =0V                                                     | --   | 0.8  | 1.2  | V    |
| t <sub>rr</sub>                                                                      | Reverse Recovery Time                                  | T <sub>j</sub> =25°C,I <sub>sd</sub> =15A,<br>V <sub>GS</sub> =0V<br>di/dt=100A/μs           | --   | 36   | --   | nS   |
| Q <sub>rr</sub>                                                                      | Reverse Recovery Charge                                |                                                                                              |      | 48   |      | nC   |

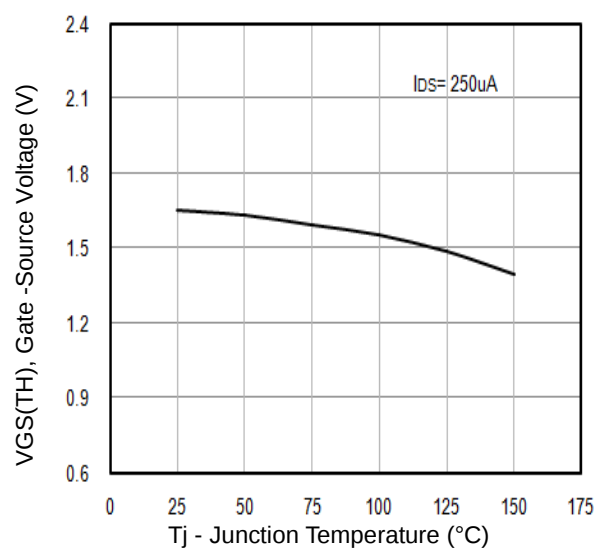
NOTE:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Limited by T<sub>Jmax</sub>, starting T<sub>J</sub> = 25°C, L = 0.5mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 10A, V<sub>GS</sub> =10V. Part not recommended for use above this value
- ③ Pulse width ≤ 300μs; duty cycles ≤ 2%.

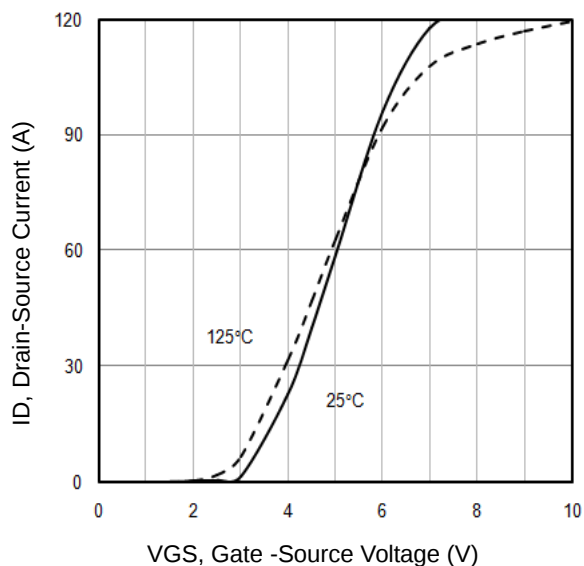
## Typical Characteristics



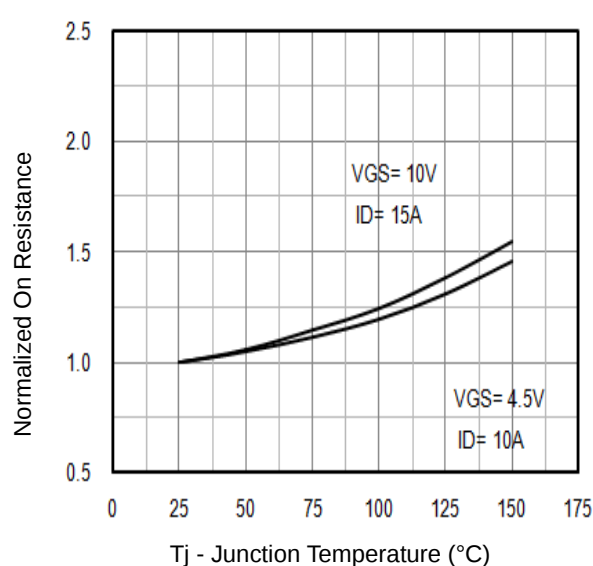
**Fig1.** Typical Output Characteristics



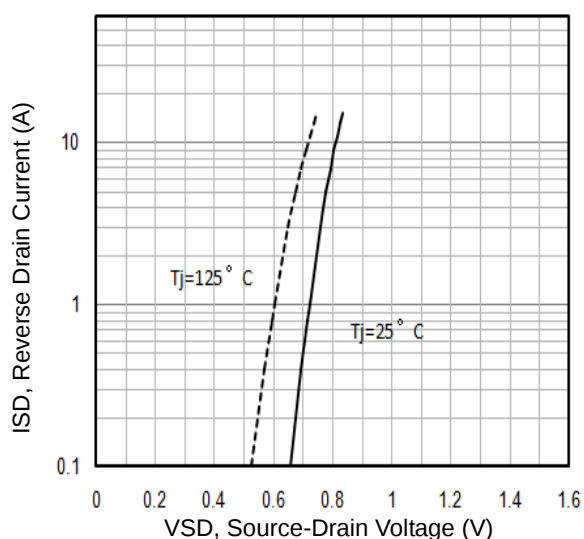
**Fig2.**  $V_{GS(TH)}$  Gate-Source Voltage Vs.  $T_j$



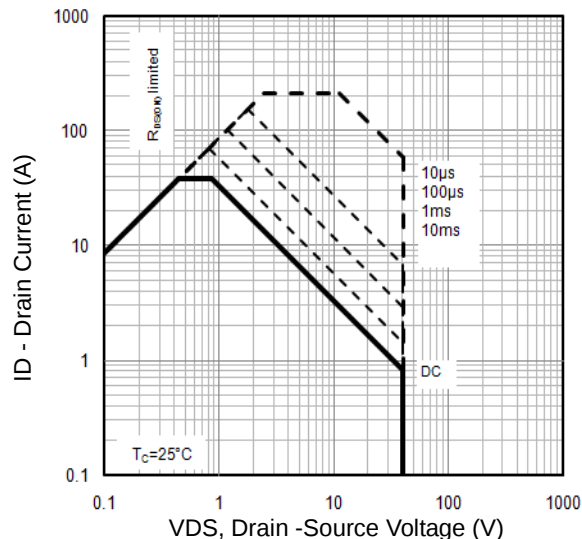
**Fig3.** Typical Transfer Characteristics



**Fig4.** Normalized On-Resistance Vs.  $T_j$

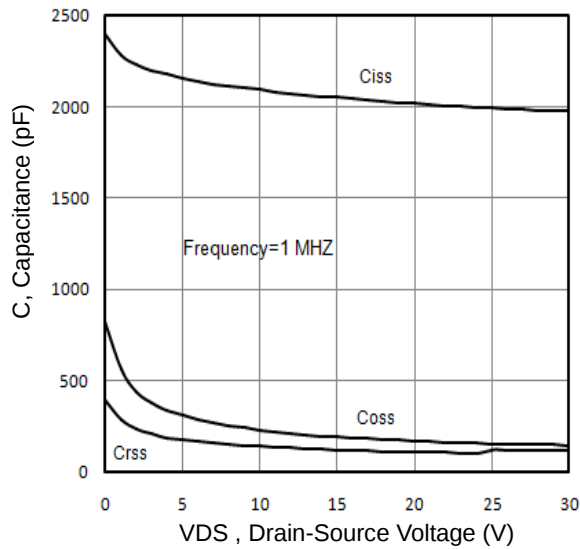


**Fig5.** Typical Source-Drain Diode Forward Voltage

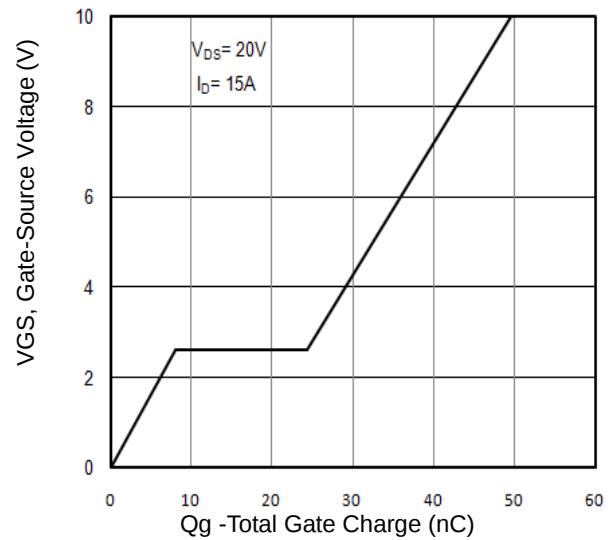


**Fig6.** Maximum Safe Operating Area

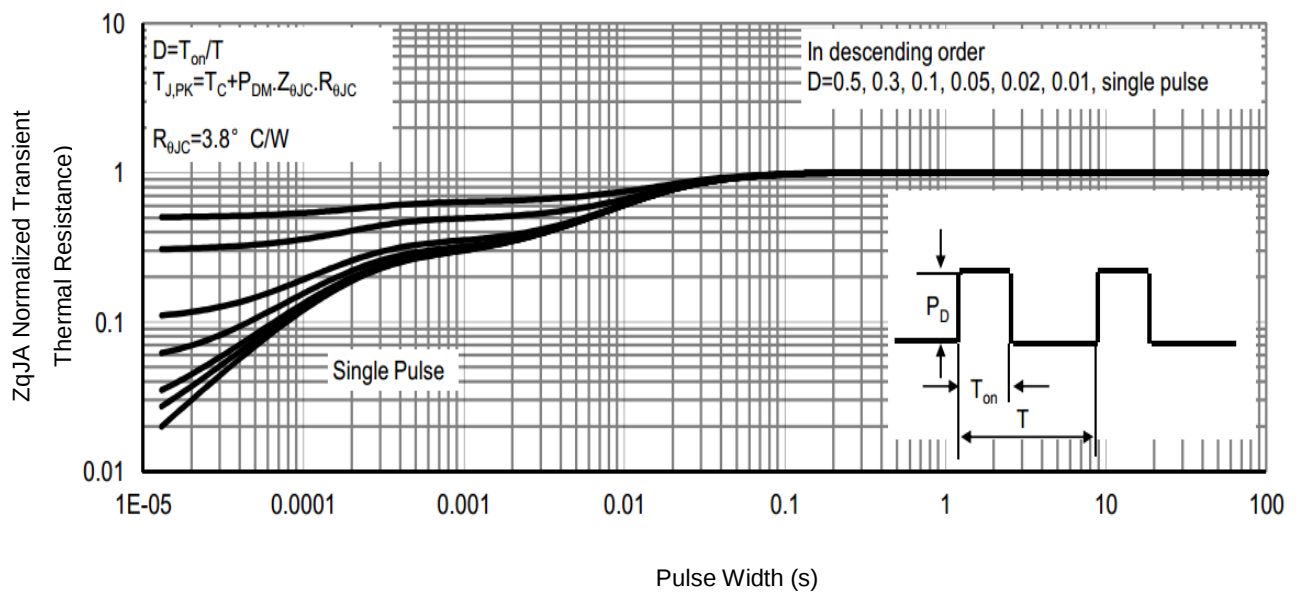
## Typical Characteristics



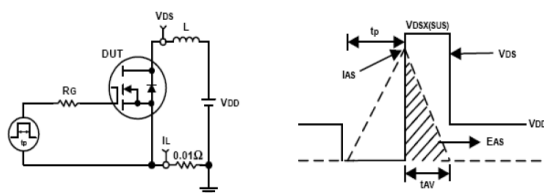
**Fig7.** Typical Capacitance Vs. Drain-Source Voltage



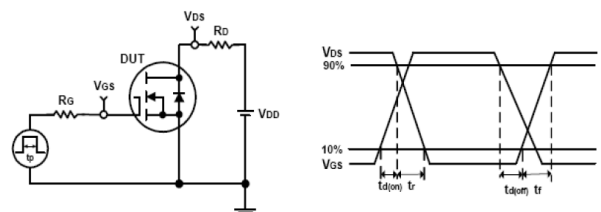
**Fig8.** Typical Gate Charge Vs. Gate-Source Voltage



**Fig9.** Normalized Maximum Transient Thermal Impedance

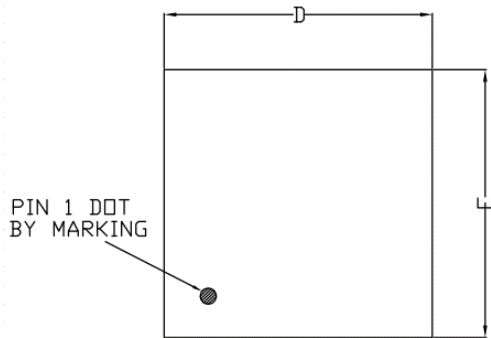


**Fig10.** Unclamped Inductive Test Circuit and waveforms

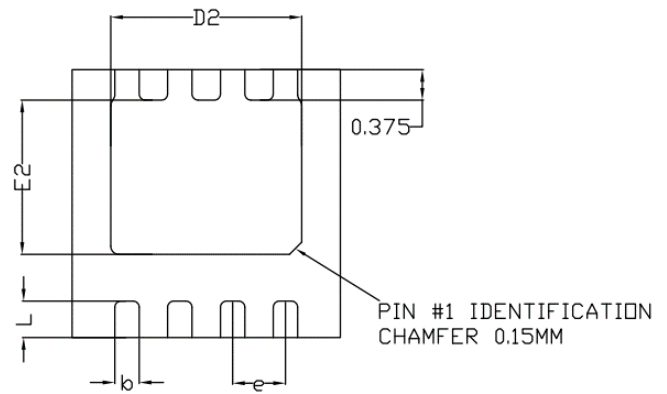


**Fig11.** Switching Time Test Circuit and waveforms

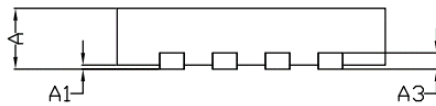
### TDFN3.3x3.3 Package Outline Data



TOP VIEW



BOTTOM VIEW



SIDE VIEW

| Symbol | Dimensions (unit: mm) |      |      |
|--------|-----------------------|------|------|
|        | Min                   | Typ  | Max  |
| A      | 0.70                  | 0.75 | 0.80 |
| A1     | 0.00                  | --   | 0.05 |
| A3     | 0.20 REF              |      |      |
| D      | 3.25                  | 3.30 | 3.35 |
| E      | 3.25                  | 3.30 | 3.35 |
| D2     | 2.30                  | 2.35 | 2.40 |
| E2     | 1.85                  | 1.90 | 1.95 |
| b      | 0.25                  | 0.30 | 0.35 |
| L      | 0.35                  | 0.45 | 0.55 |
| e      | 0.65 BSC              |      |      |

Notes:

1. Refer to JEDEC MO-240 variation CA.

### Customer Service

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