

## Description

The VSU65R200GN1 650V, 175mΩ Gallium Nitride (GaN) FET are normally-off devices. They combine state-of-the-art high voltage GaN HEMT and low voltage silicon MOSFET technologies—offering superior reliability and performance.

|                               |     |    |
|-------------------------------|-----|----|
| $V_{DS}$                      | 650 | V  |
| $R_{DS(on),TYP@ V_{GS}=10V}$  | 175 | mΩ |
| $R_{DS(on),TYP@ V_{GS}=4.5V}$ | 180 | mΩ |
| $I_D$                         | 20  | A  |

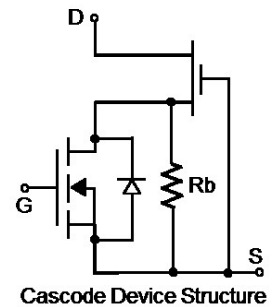
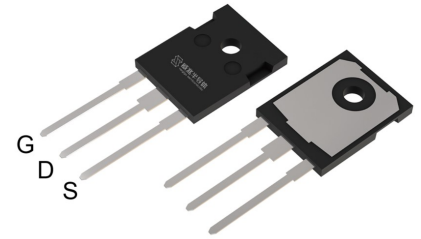
## Features

- JEDEC qualified GaN technology
- Ultra fast switching
- No reverse-recverse conduction
- Low gate charge,low output charge
- Pb-free lead plating; RoHS compliant



| Part ID      | Package Type | Marking | Packing    |
|--------------|--------------|---------|------------|
| VSU65R200GN1 | TO-247       | 65R200  | 30pcs/Tube |

TO-247



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

| Symbol         | Parameter                               | Rating                          | Unit             |
|----------------|---|---------------------------------|------------------|
| $V_{(BR)DSS}$  | Drain-Source breakdown voltage          | 650                             | V                |
| $V_{GS}$       | Gate-Source voltage                     | $\pm 20$                        | V                |
| $I_S$          | Diode continuous forward current        | $T_C=25\text{ }^\circ\text{C}$  | 20<br>A          |
| $I_D$          | Continuous drain current @ $V_{GS}=10V$ | $T_C=25\text{ }^\circ\text{C}$  | 20<br>A          |
|                |   | $T_C=100\text{ }^\circ\text{C}$ | 13<br>A          |
| $I_{DM}$       | Pulse drain current tested ①            | $T_C=25\text{ }^\circ\text{C}$  | 80<br>A          |
| $P_D$          | Maximum power dissipation               | $T_C=25\text{ }^\circ\text{C}$  | 156<br>W         |
| $T_{STG}, T_J$ | Storage and Junction Temperature Range  | -55 to 150                      | $^\circ\text{C}$ |

## Thermal Characteristics

| Symbol          | Parameter                               | Typical | Unit               |
|-----------------|---|---------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | 0.8     | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 40      | $^\circ\text{C/W}$ |

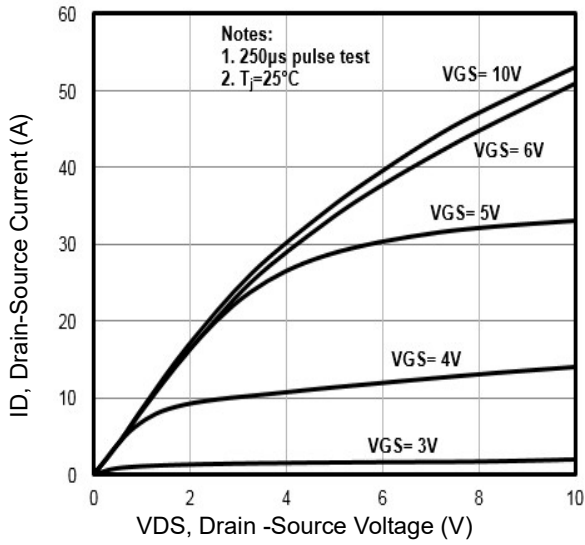
**Typical Characteristics**

| Symbol  | Parameter  | Condition   | Min. | Typ. | Max. | Unit |
|---|--|---|------|------|------|------|
| <b>Static Electrical Characteristics @ T<sub>j</sub> = 25°C (unless otherwise stated)</b>   |  |   |      |      |      |      |
| V <sub>(BR)DSS</sub>  | Drain-Source Breakdown Voltage                         | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA  | 650  | --   | --   | V    |
| I <sub>DSS</sub>  | Zero Gate Voltage Drain Current                        | V <sub>DS</sub> =650V, V <sub>GS</sub> =0V  | --   | --   | 20   | μA   |
|   | Zero Gate Voltage Drain Current(T <sub>j</sub> =150°C) | V <sub>DS</sub> =650V, V <sub>GS</sub> =0V  | --   | 10   | --   | μA   |
| I <sub>GSS</sub>  | Gate-Body Leakage Current                              | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V  | --   | --   | ±200 | nA   |
| V <sub>GS(TH)</sub>   | Gate Threshold Voltage                                 | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                      | 1.3  | 2.0  | 2.5  | V    |
| R <sub>DS(ON)</sub>   | Drain-Source On-State Resistance ②                     | V <sub>GS</sub> =10V, I <sub>D</sub> =10A   | --   | 175  | 220  | mΩ   |
|   |  | T <sub>j</sub> =100°C   | --   | 230  | --   | mΩ   |
| R <sub>DS(ON)</sub>   | Drain-Source On-State Resistance ②                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =8A   | --   | 180  | 230  | mΩ   |
| <b>Dynamic Electrical Characteristics @ T<sub>j</sub> = 25°C (unless otherwise stated)</b>  |  |   |      |      |      |      |
| C <sub>iss</sub>  | Input Capacitance                                      | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V,<br>f=1MHz  | --   | 780  | --   | pF   |
| C <sub>oss</sub>  | Output Capacitance                                     |   | --   | 215  | --   | pF   |
| C <sub>rss</sub>  | Reverse Transfer Capacitance                           |   | --   | 9    | --   | pF   |
| R <sub>g</sub>  | Gate Resistance  | f=1MHz  | --   | 1.8  | --   | Ω    |
| Q <sub>g</sub> (10V)  | Total Gate Charge                                      | V <sub>DS</sub> =400V, I <sub>D</sub> =10A,<br>V <sub>GS</sub> =10V                           | --   | 13   | --   | nC   |
| Q <sub>g</sub> (4.5V)   | Total Gate Charge                                      |   | --   | 6.3  | --   | nC   |
| Q <sub>gs</sub>   | Gate-Source Charge                                     |   | --   | 3.1  | --   | nC   |
| Q <sub>gd</sub>   | Gate-Drain Charge                                      |   | --   | 2.1  | --   | nC   |
| <b>Switching Characteristics</b>  |  |   |      |      |      |      |
| t <sub>d(on)</sub>  | Turn-on Delay Time                                     | V <sub>DD</sub> =400V,<br>I <sub>D</sub> =4A,<br>R <sub>G</sub> =10Ω,<br>V <sub>GS</sub> =10V | --   | 11   | --   | ns   |
| t <sub>r</sub>  | Turn-on Rise Time                                      |   | --   | 10   | --   | ns   |
| t <sub>d(off)</sub>   | Turn-Off Delay Time                                    |   | --   | 28   | --   | ns   |
| t <sub>f</sub>  | Turn-Off Fall Time                                     |   | --   | 44   | --   | ns   |
| <b>Source- Drain Diode Characteristics @ T<sub>j</sub> = 25°C (unless otherwise stated)</b> |  |   |      |      |      |      |
| V <sub>SD</sub>   | Forward on voltage                                     | I <sub>SD</sub> =10A, V <sub>GS</sub> =0V   | --   | 2.4  | 3    | V    |
| t <sub>rr</sub>   | Reverse Recovery Time                                  | T <sub>j</sub> =25°C, I <sub>sd</sub> =10A,<br>V <sub>GS</sub> =0V                            | --   | 0    | --   | ns   |
| Q <sub>rr</sub>   | Reverse Recovery Charge                                | di/dt=100A/μs   | --   | 0    | --   | nC   |

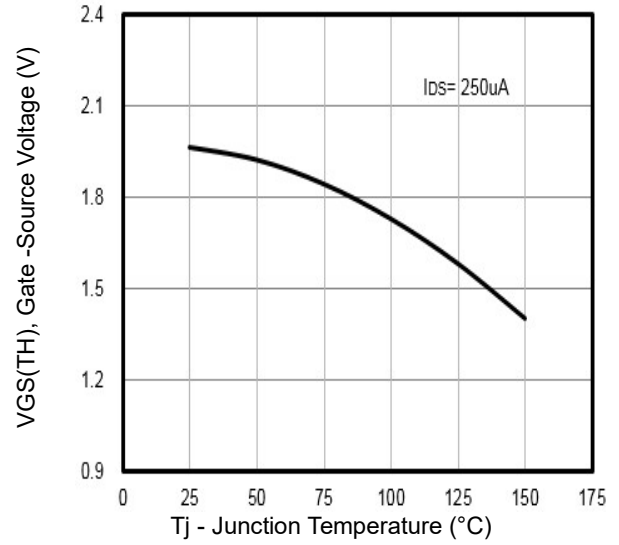
NOTE: ① Repetitive rating; pulse width limited by max junction temperature.

② Pulse width ≤ 380μs; duty cycles ≤ 2%.

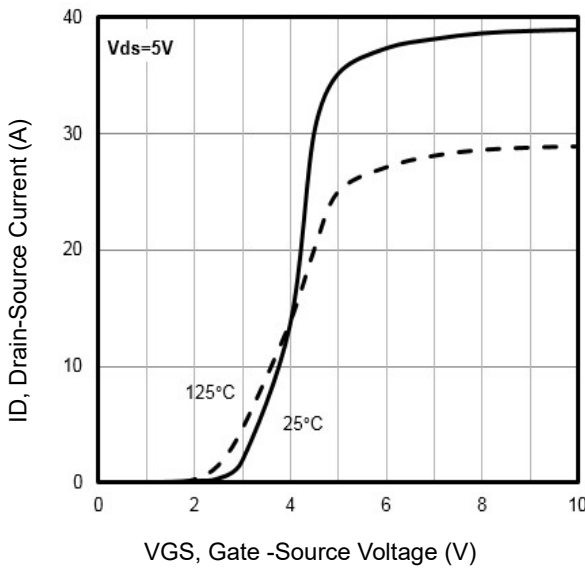
**Typical Characteristics**



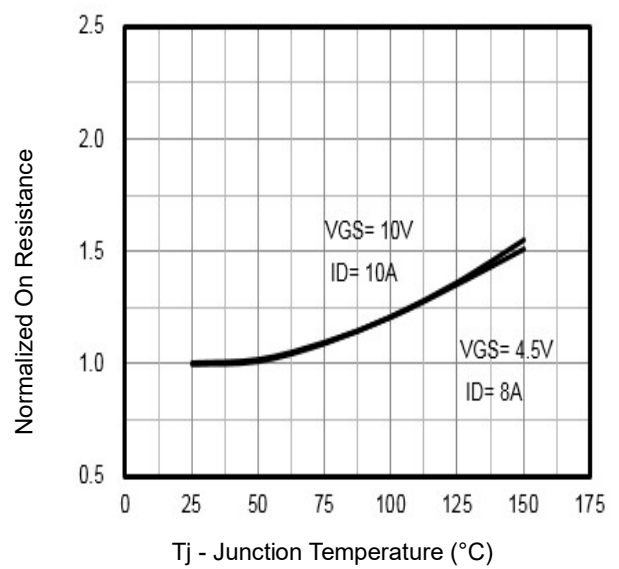
**Fig1.** Typical Output Characteristics



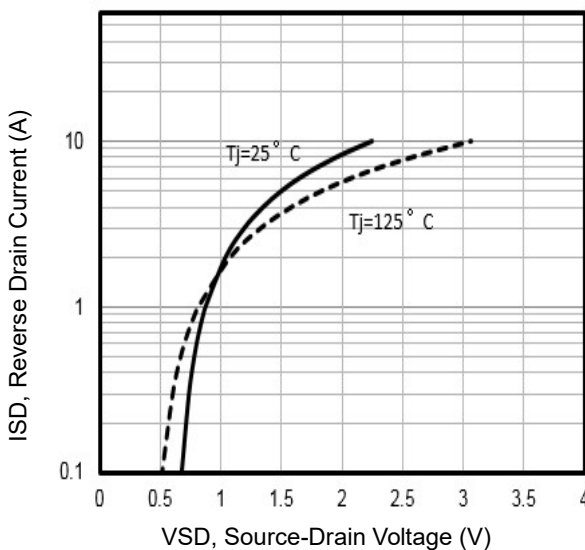
**Fig2.**  $V_{GS(TH)}$  Gate -Source Voltage Vs.  $T_j$



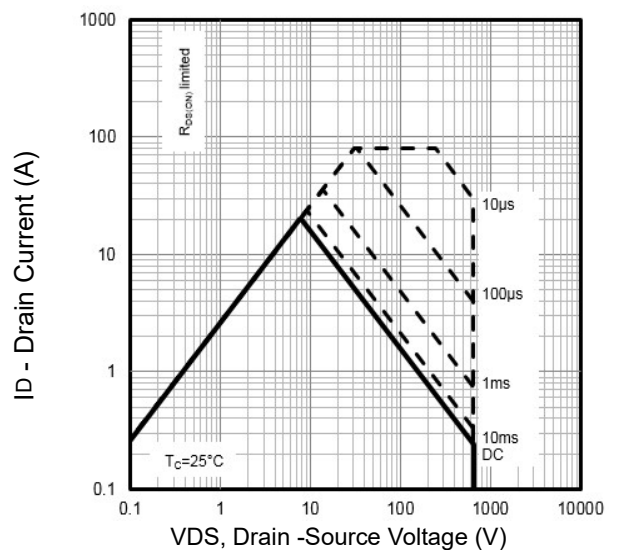
**Fig3.** Typical Transfer Characteristics



**Fig4.** Normalized On-Resistance Vs. Temperature

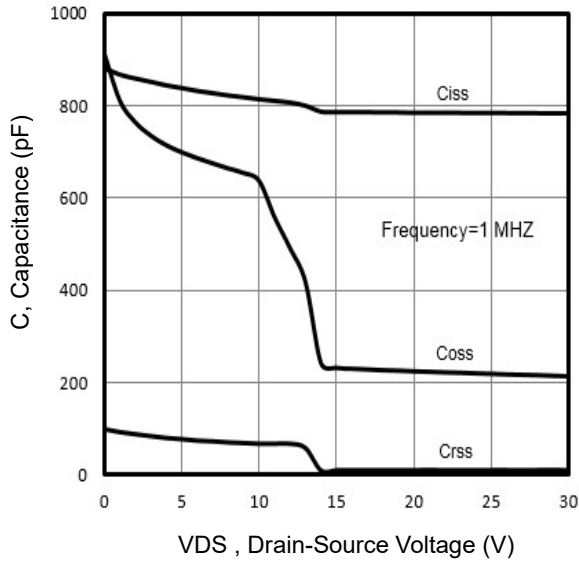


**Fig5.** Typical Source-Drain Diode Forward Voltage

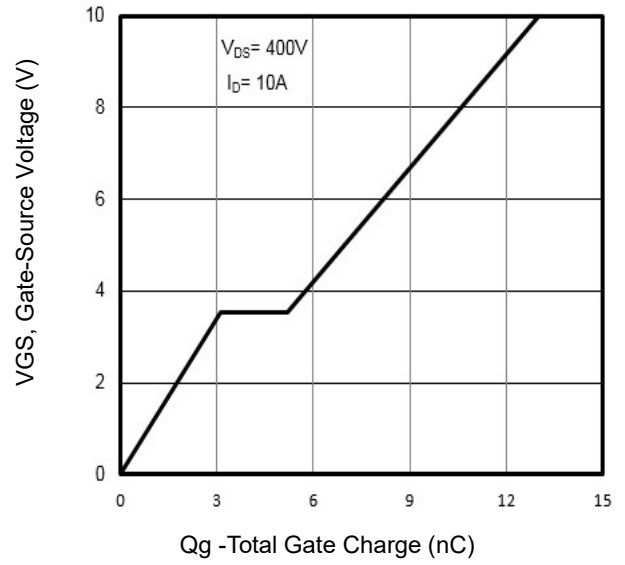


**Fig6.** Maximum Safe Operating Area

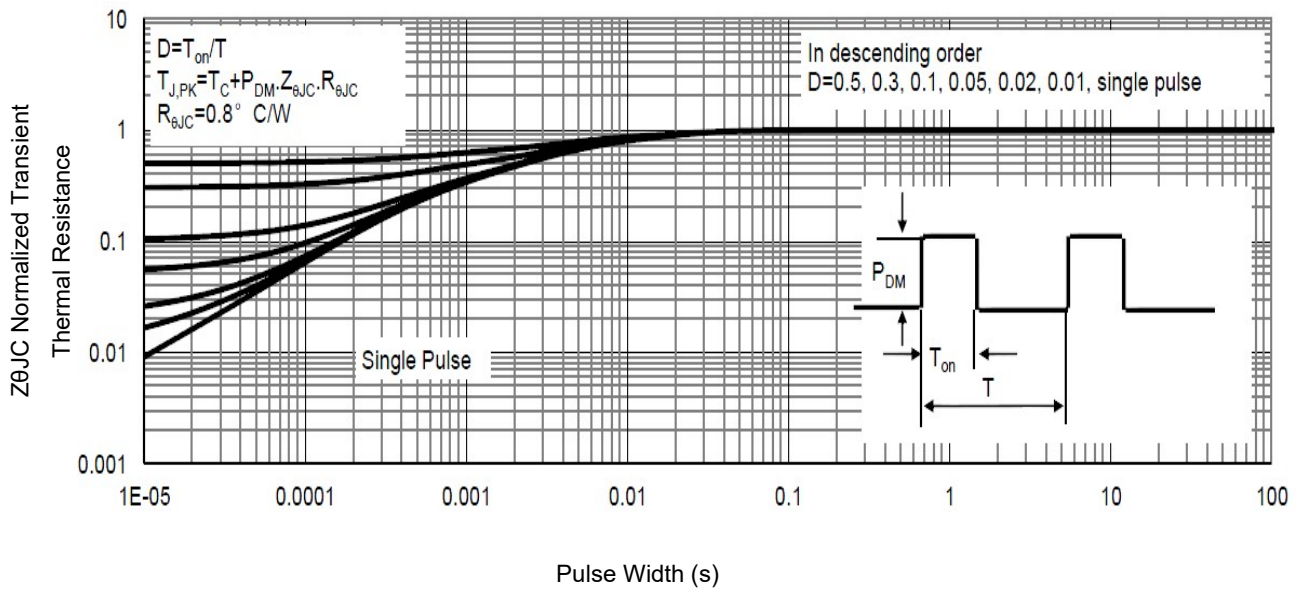
**Typical Characteristics**



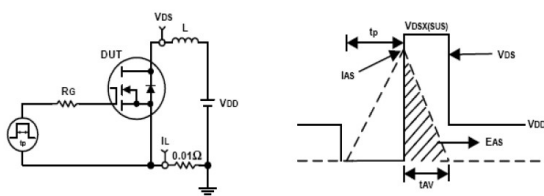
**Fig7.** Typical Capacitance Vs.Drain-Source Voltage



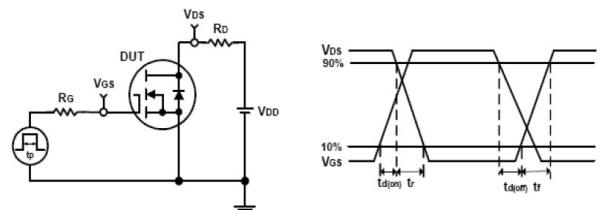
**Fig8.** Typical Gate Charge Vs.Gate-Source Voltage



**Fig9 .** Normalized Maximum Transient Thermal Impedance

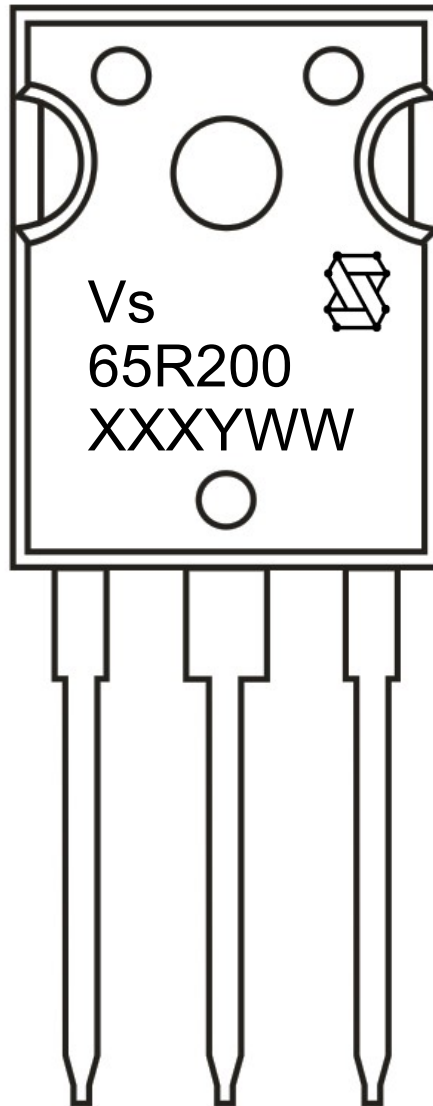


**Fig10.** Unclamped Inductive Test Circuit and waveforms



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

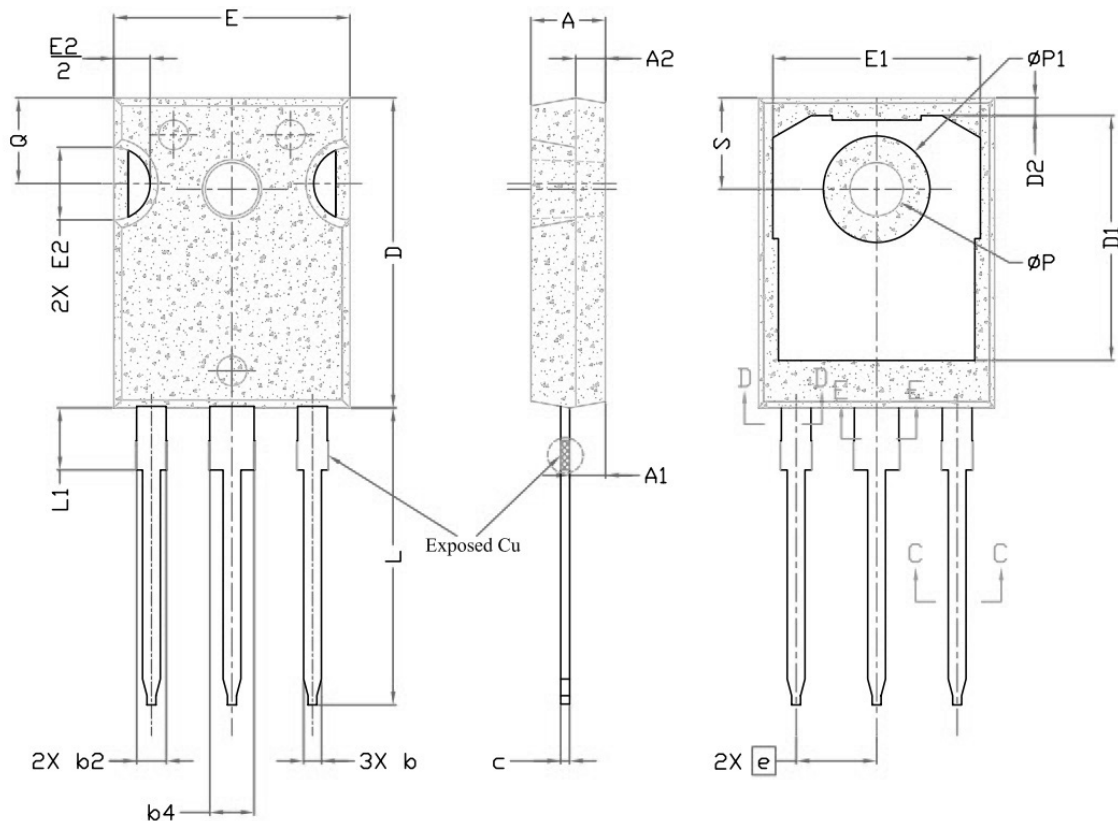
### Marking Information



- 1st line: Vergiga Code (Vs) , Vergiga Logo
- 2nd line: Part Number (65R200)
- 3rd line: Date code (XXXYWW)
  - XXX: Wafer Lot Number Code , code changed with Lot Number
  - Y: Year Code , refer to table below
  - WW: Week Code (01 to 53)

| Code | C    | D    | E    | F    | G    | H    | J    | K    | L    | M    | N    | P    | Q    | R    | S    | T    |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |

### TO-247 Package Outline Data



| Symbol | Dimensions (unit: mm) |       |       |
|--------|-----------------------|-------|-------|
|        | Min                   | Typ   | Max   |
| A      | 4.83                  | 5.02  | 5.21  |
| A1     | 2.29                  | 2.41  | 2.55  |
| A2     | 1.50                  | 2.00  | 2.49  |
| b      | 1.12                  | 1.20  | 1.33  |
| b2     | 1.91                  | 2.00  | 2.39  |
| b4     | 2.87                  | 3.00  | 3.22  |
| c      | 0.55                  | 0.60  | 0.69  |
| D      | 20.80                 | 20.95 | 21.10 |
| D1     | 16.25                 | 16.55 | 17.65 |
| E      | 15.75                 | 15.94 | 16.13 |
| E1     | 13.46                 | 14.02 | 14.16 |
| E2     | 4.32                  | 4.91  | 5.49  |
| e      | 5.44 BSC              |       |       |
| L      | 19.81                 | 20.07 | 20.32 |
| L1     | 4.10                  | 4.19  | 4.40  |
| ΦP     | 3.56                  | 3.61  | 3.65  |
| ΦP1    | 7.19REF.              |       |       |
| Q      | 5.39                  | 5.79  | 6.20  |
| S      | 6.04                  | 6.17  | 6.30  |

Notes:

1. Refer to JEDEC TO-247 variation AD
2. Dimension "D" and "E" do NOT include mold flash. Mold flash shall not exceed 0.127mm per side.

### Customer Service

Sales and Service:

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