

SuperMOS –TO-220 40V BV_{DSS} , $1.65m\Omega R_{DS(ON)}$, N-channel MOSFET

1. Description

The ESGNU04R023 is N-Channel enhancement MOS Field Effect Transistor. Uses advanced technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. Device is suitable for use in DC-DC conversion, power switch and charging circuit. Standard Product ESGNU04R023 is Pb-free.

2. Features

- 40V, $R_{DS(ON)}=1.65m\Omega(Typ.) @V_{GS}=10V$
- $R_{DS(ON)}=2.45m\Omega(Typ.) @V_{GS}=4.5V$
- High density cell design for low $R_{DS(on)}$
- Material: Halogen free
- Reliable and rugged
- Avalanche Rated
- Low leakage current

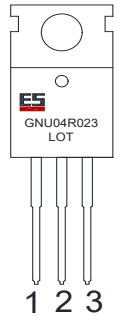
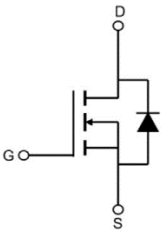
3. Applications

- PWM applications 100% UIS TESTED
- Load switch
- Power management in portable/desktop PCs
- DC/DC conversion

4. Ordering Information

| Part Number | Package | Marking | Material | Packing | Quantity per Tube | Flammability Rating |
|-------------|---------|-------------------|--------------|---------|-------------------|---------------------|
| ESGNU04R023 | TO-220 | GNU04R023/ LOT | Halogen free | Tube | 50 PCS | UL 94V-0 |

5. Pin Configuration and Functions

| Pin | Function | Outline | Circuit Diagram |
|-----|----------|---|---|
| 1 | Gate |  |  |
| 3 | Source | | |
| 2 | Drain | | |

6. Specification

Absolute Maximum Rating & Thermal Characteristics

Ratings at 25 °C ambient temperature unless otherwise specified.

| Parameter | Symbol | Limit | Unit |
|--|------------------------|------------|------|
| Drain-Source Voltage | BV_{DSS} | 40 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Continuous Drain Current | I_D | 140 | A |
| | $T_C=25^\circ\text{C}$ | | |
| Maximum Power Dissipation | P_D | 83 | W |
| Pulsed Drain Current | I_{DM} | 560 | A |
| Single Pulse Avalanche Energy ^a | E_{AS} | 200 | mJ |
| Operating Junction Temperature | T_J | 150 | °C |
| Lead Temperature | T_L | 260 | °C |
| Storage Temperature Range | T_{stg} | -55 to 150 | °C |

Thermal resistance ratings

| Single Operation | | | | |
|-------------------------------------|-----------------|---------|---------|------|
| Parameter | Symbol | Typical | Maximum | Unit |
| Junction-to-Case Thermal Resistance | $R_{\theta JC}$ | | 1.5 | °C/W |

Notes:

- a. EAS condition: Starting $T_J=25^\circ\text{C}$, $V_{DD}=32\text{V}$, $V_G=10\text{V}$, $R_G=25\Omega$, $L=0.5\text{mH}$

Electrical Characteristics

At TA = 25°C unless otherwise specified

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|--|--------------|--|------|------|-----------|------------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-to-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 40 | | | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=40V, V_{GS}=0V$ | | | 1.0 | μA |
| Gate-to-source Leakage Current | I_{GSS} | $V_{DS}=0V, V_{GS}=\pm 20V$ | | | ± 100 | nA |
| ON CHARACTERISTICS | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}=V_{DS}, I_D=250\mu A$ | 1.0 | | 2.5 | V |
| Drain-to-source On-resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=20A$ | | 1.65 | 2.3 | m Ω |
| | | $V_{GS}=4.5V, I_D=20A$ | | 2.45 | 3.2 | |
| CHARGES, CAPACITANCES AND GATE RESISTANCE | | | | | | |
| Input Capacitance | C_{ISS} | $V_{GS}=0V, f=1MHz, V_{DS}=25V$ | | 3830 | | pF |
| Output Capacitance | C_{OSS} | | | 2800 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 480 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}=10V, V_{DD}=32V, I_D=10A$ | | 66 | | nC |
| Gate-to-Source Charge | Q_{GS} | | | 13.6 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 12.6 | | |
| SWITCHING CHARACTERISTICS | | | | | | |
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS}=10V, V_{DD}=20V, I_D=20A, R_G=0.5\Omega$ | | 890 | | ns |
| Rise Time | t_r | | | 21 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 72 | | |
| Fall Time | t_f | | | 34 | | |
| BODY DIODE CHARACTERISTICS | | | | | | |
| Forward Voltage | V_{SD} | $V_{GS}=0V, I_S=20A$ | | | 1.5 | V |

7. Typical Characteristics

Figure 1: Output Characteristics

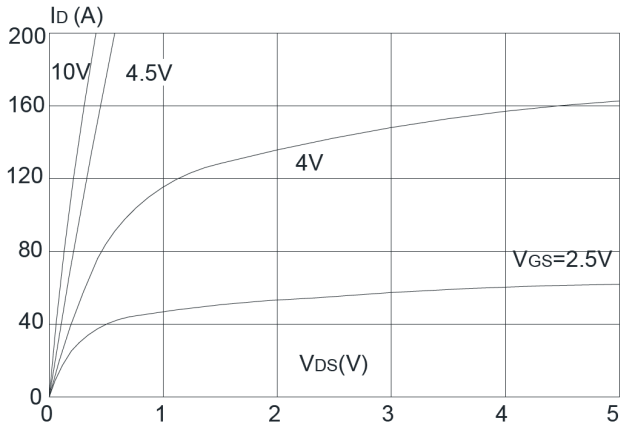


Figure 2: Typical Transfer Characteristics

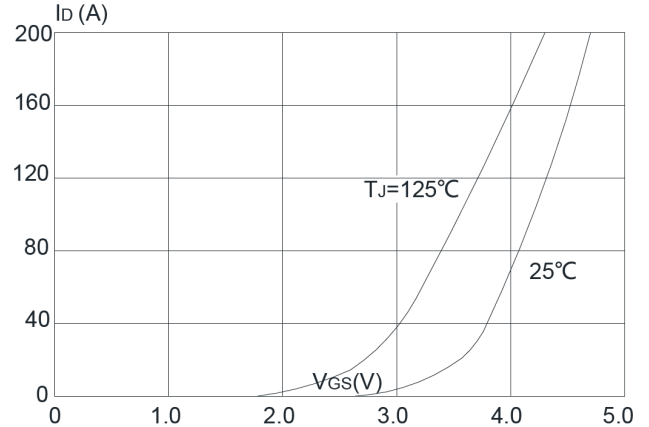


Figure 3: On-resistance vs. Drain Current

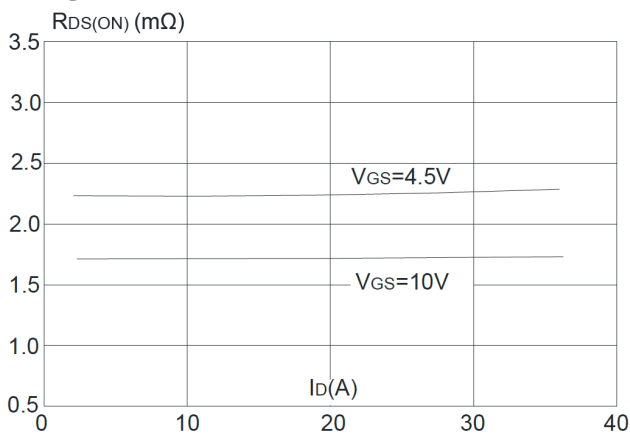


Figure 4: Body Diode Characteristics

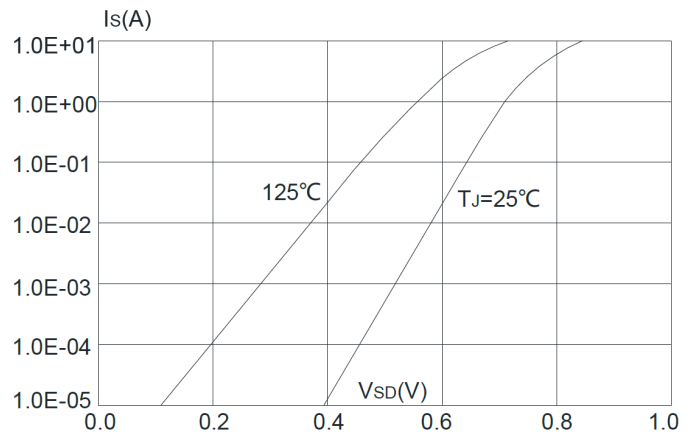


Figure 5: Gate Charge Characteristics

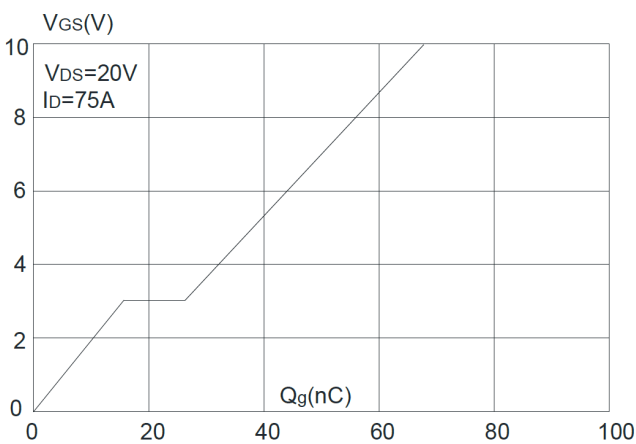


Figure 6: Capacitance Characteristics

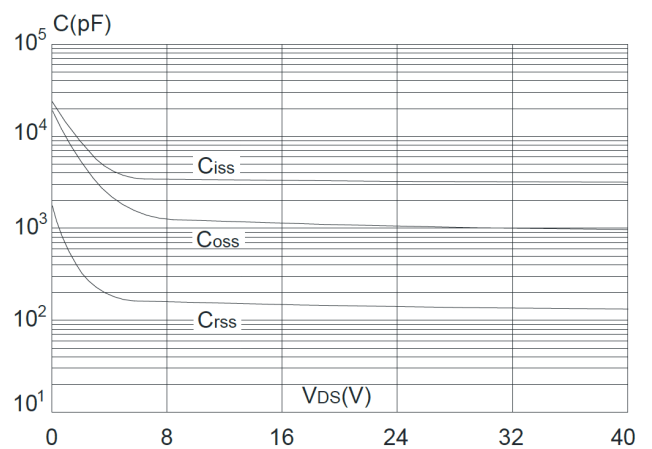


Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

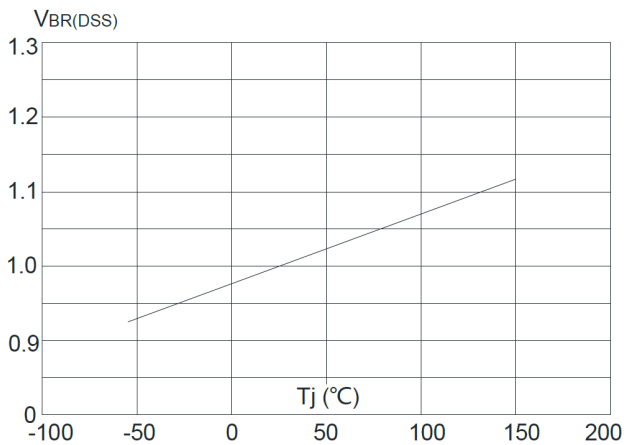


Figure 8: Normalized on Resistance vs. Junction Temperature

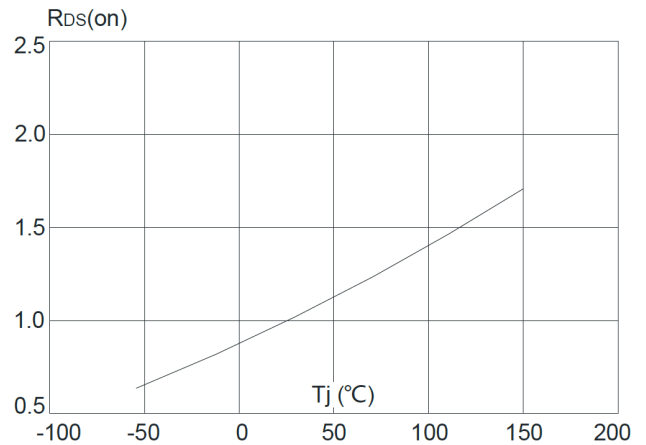


Figure 9: Maximum Safe Operating Area

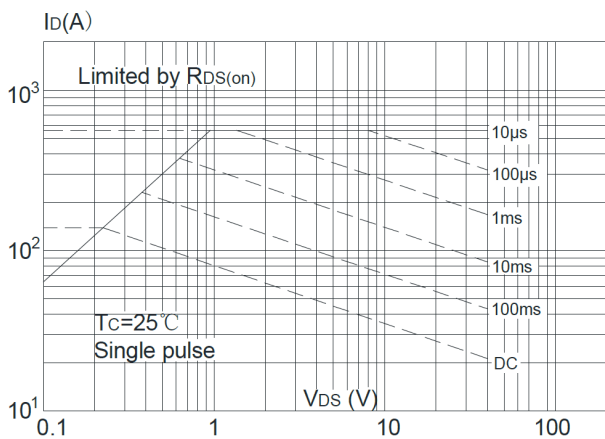


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

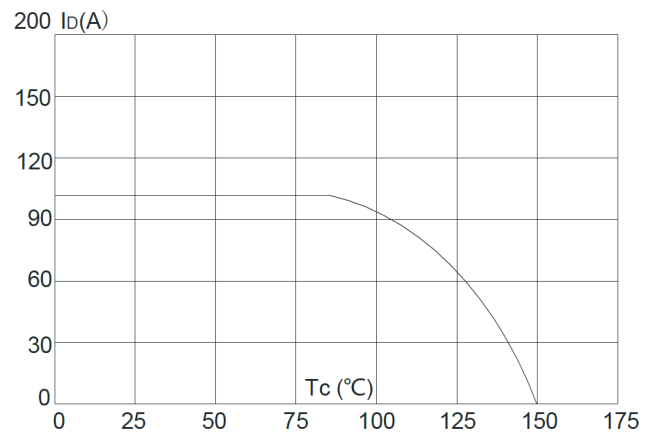
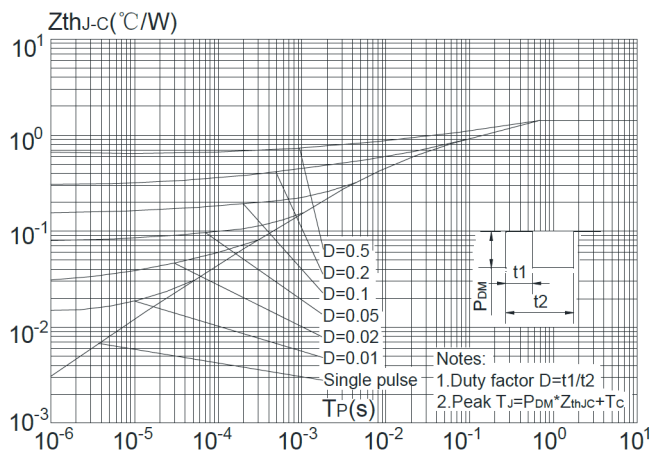
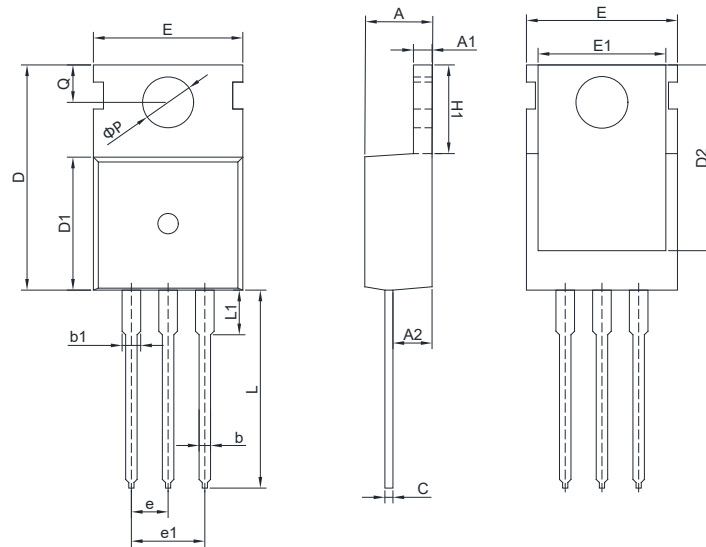


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case



8. Dimension (TO-220)



COMMON DIMENSIONS: UNITS OF MEASURE=MILLIMETER

| | | | | | | | | | |
|---------|-------|------|-------|-------|------|-------|-------|------|-------|
| SYMBOLS | A | A1 | A2 | b | b1 | c | D | D1 | D2 |
| MIN | 4.25 | 1.25 | 2.35 | 0.7 | 1.15 | 0.45 | 14.35 | 8.80 | 13.05 |
| MAX | 4.65 | 1.35 | 2.55 | 0.9 | 1.75 | 0.60 | 15.95 | 9.50 | 13.65 |
| SYMBOLS | E | E1 | e | e1 | H1 | L | L1 | Q | ΦP |
| MIN | 9.90 | 7.85 | 2.540 | 5.080 | 6.30 | 12.85 | 2.85 | 2.70 | 3.50 |
| MAX | 10.35 | 8.85 | BSC | BSC | 6.65 | 13.50 | 3.25 | 2.90 | 3.70 |

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