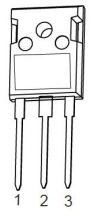
SZCJ

# TO-247-A Plastic-Encapsulate MOSFET

## 021SN20MK N-Channel Power MOSFET

**TO-247-A**




1.GATE
2.DRAIN
3.SOURCE

### Key Performance Parameters

| $V_{BR(DSS)}$ | $R_{DS(on)}$TYP | $I_D$ |
|---|---|---|
| 200V | 17mΩ@10V | 85A |

## DESCRIPTION

The N-Channel enhancement mode power field effect transistors is using SGT technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.These devices are well suited for high efficiency fast switching applications.

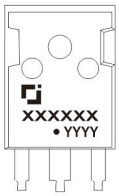
## FEATURES

- 100% Avalanche tested
- Low drain-source on-resistance
- Low gate charge
- High current capability

## APPLICATIONS

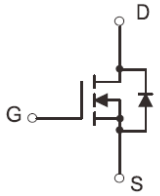
- DC/DC
- Switching application

## MARKING




XXXXXX = 021SN20MK
Solid dot = Green molding compound device.
YYYY = Code.

## EQUIVALENT CIRCUIT




### ABSOLUTE MAXIMUM RATINGS ( $T_J$=25℃ unless otherwise specified )

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 200 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current | $T_C$ =25℃ | $I_D$ | 85 | A |
| | $T_C$ =100℃ | | 54 | |
| Pulsed Drain Current | | $I_{DM}$①② | 340 | A |
| Continuous Drain Current | $T_A$ =25℃ | $I_D$ | 7.5 | A |
| | $T_A$ =75℃ | | 5.9 | |
| Avalanche Current | | $I_{AS}$③ | 26 | A |
| Single Pulsed Avalanche Energy | | $E_{AS}$③ | 169 | mJ |
| Power Dissipation | | $P_D$① | 357 | W |
| Operating Junction and Storage Temperature Range | | $T_J$,$T_{stg}$ | -55~+150 | ℃ |

### Thermal Characteristics

| Parameter | Symbol | Value | | Unit |
|---|---|---|---|---|
| | | Typ | Max | |
| Thermal Resistance from Junction to Case | $R_{\theta JC}$ | 0.23 | 0.35 | ℃/W |
| Thermal Resistance from Junction to Ambient | $R_{\theta JA}$⑥ | 30 | 45 | ℃/W |

# Typical Characteristics

## ELECTRICAL CHARACTERISTICS ($T_J$=25℃ unless otherwise specified)

### Static Characteristics

| Parameter | Symbol | Test Condition | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0V, $I_D$=250μA | | 200 | - | - | V |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=200V, $V_{GS}$=0V | $T_J$=25℃ | - | - | 1.0 | μA |
| | | | $T_J$=125℃ | - | - | 100 | |
| Gate-body leakage current | $I_{GSS}$ | $V_{GS}$=±20V, $V_{DS}$=0V | | - | - | ±100 | nA |
| Gate-threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | | 2.0 | 3.0 | 4.0 | V |
| Static drain-source on-sate resistance | $R_{DS(on)}$④ | $V_{GS}$=10V, $I_D$=20A | $T_J$=25℃ | - | 17 | 21 | mΩ |
| | | | $T_J$=125℃ | - | 34 | 43 | |
| Forward transconductance | $g_{FS}$ | $V_{DS}$=5V, $I_D$=20A | | - | 45 | - | S |

### Dynamic Characteristics⑤

| | | | | | | |
|---|---|---|---|---|---|---|
| Input capacitance | $C_{iss}$ | $V_{GS}$=0V, $V_{DS}$=100V, f=1MHz | - | 2677 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 217 | - | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 8 | - | |
| Gate resistance | $R_g$ | f=1MHz | - | 4.6 | - | Ω |
| Total gate charge | $Q_g$ | $V_{GS}$=10V, $V_{DS}$=100V, $I_D$=20A | - | 34.4 | - | nC |
| Gate charge at threshold | $Q_{G(th)}$ | | - | 7.5 | - | |
| Gate-source charge | $Q_{gs}$ | | - | 11.4 | - | |
| Gate-drain charge | $Q_{gd}$ | | - | 5.4 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=100V, $V_{GS}$=10V, $I_D$=20A, $R_g$=10Ω | - | 28 | - | ns |
| Turn-on rise time | $t_r$ | | - | 28 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 58 | - | |
| Turn-off fall time | $t_f$ | | - | 46 | - | |

### Reverse Diode Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| Drain-source diode forward voltage | $V_{SD}$④ | $V_{GS}$=0V, $I_S$=20A | - | - | 1.2 | V |
| Continuous drain-source diode forward current | $I_S$① | | - | - | 85 | A |
| Pulsed drain-source diode forward current | $I_{SM}$①② | | - | - | 340 | A |
| Reverse recovery time | $t_{rr}$ | $V_{DD}$=100V, $I_S$=20A, di/dt=100A/μs | - | 119 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 493 | - | nC |

Notes:

①.$T_C$=25℃ Limited only by maximum temperature allowed.

②.$P_W$ ≤10μs, Duty cycle ≤1%.

③.EAS condition: $V_{DD}$=100V, $V_{GS}$=10V, L=0.5mH, $R_g$=25Ω Starting $T_J$=25℃.

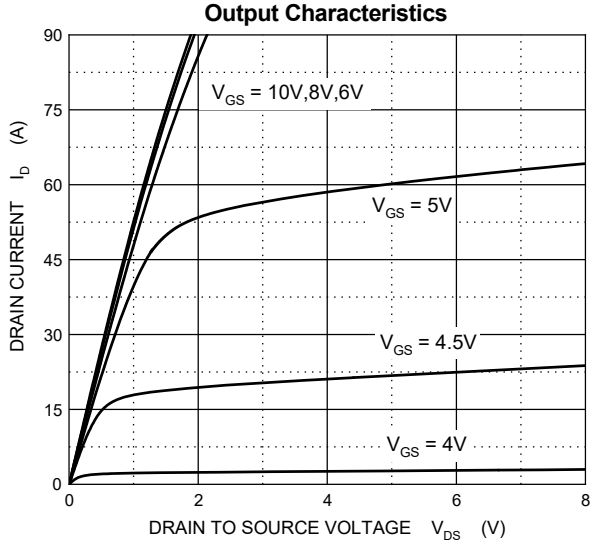
④.Pulse Test : Pulse Width ≤380μs, duty cycle ≤2%.

⑤.Guaranteed by design, not subject to production.

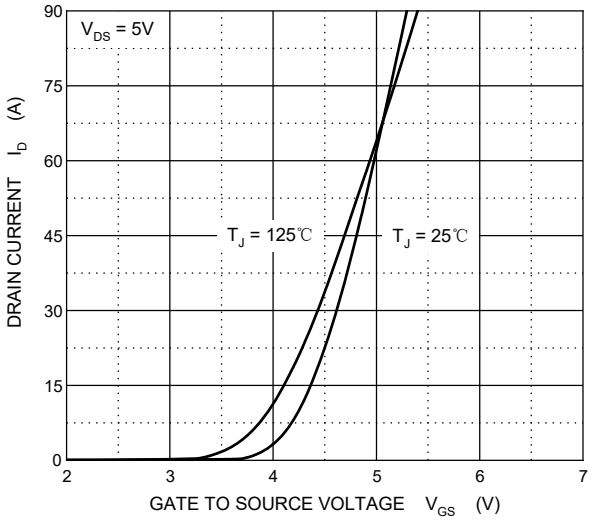
⑥.Device mounted in a still air environment with $T_A$=25℃.

# Typical Characteristics

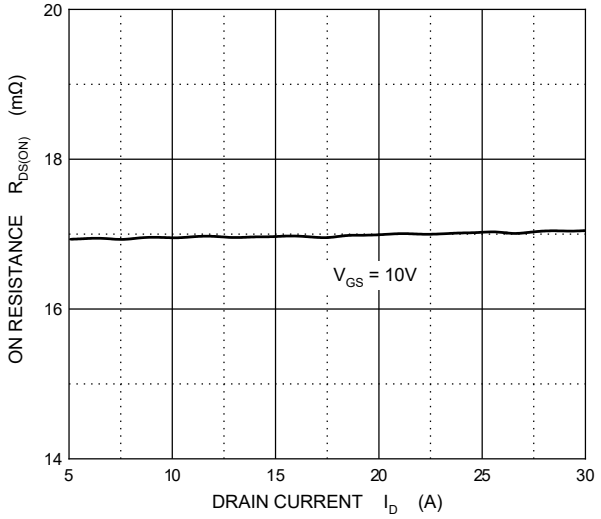
**Output Characteristics**



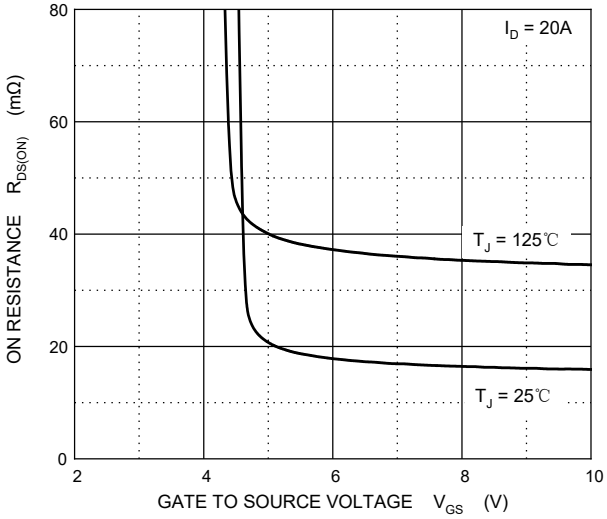

**Transfer Characteristics**



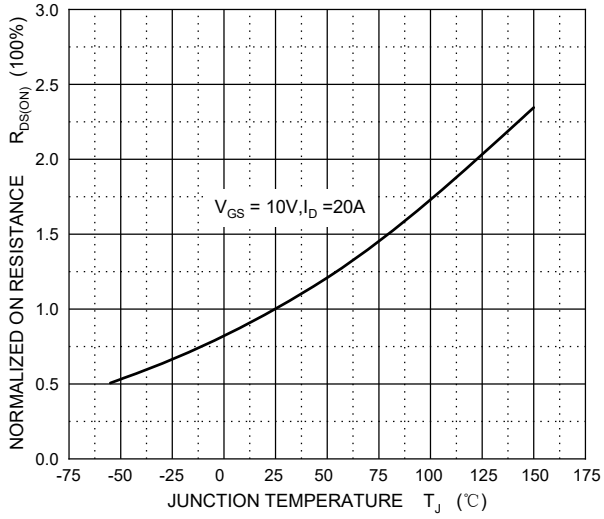

**On Resistance vs. Drain Current**



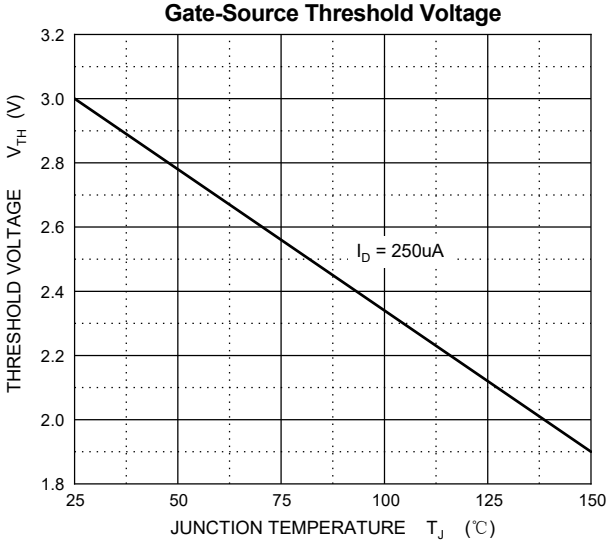

**On Resistance vs. Gate-Source Bias**




**On Resistance vs. Junction Temperature**

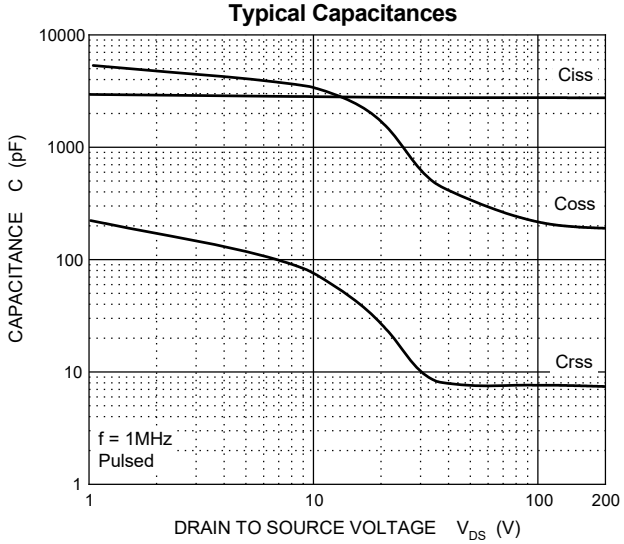



**Gate-Source Threshold Voltage**

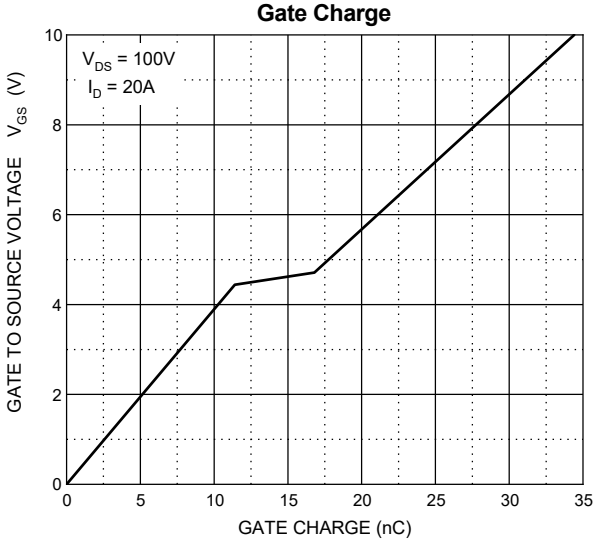


# Typical Characteristics

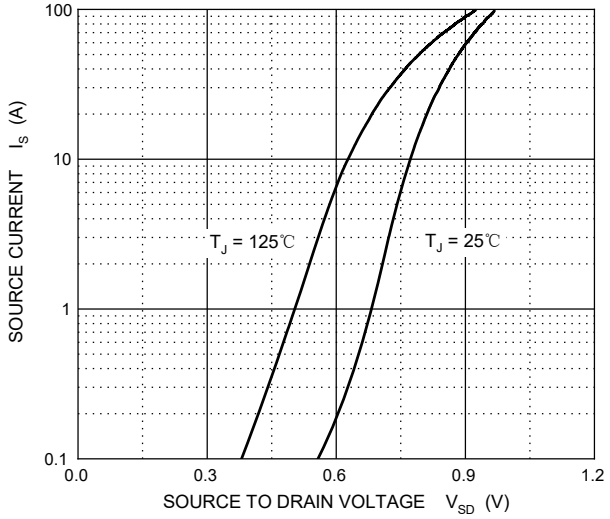
**Typical Capacitances**



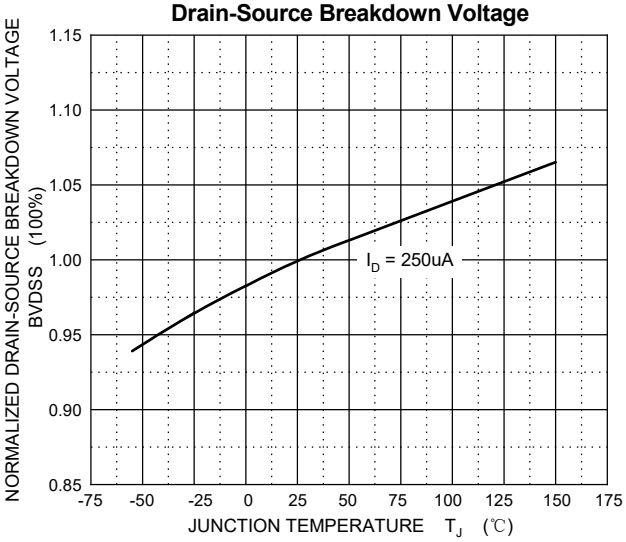

**Gate Charge**



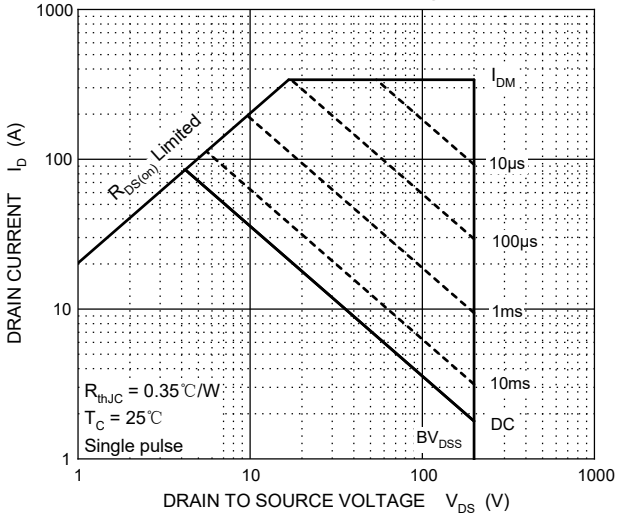

**Source-Drain Diode Forward Characteristics**



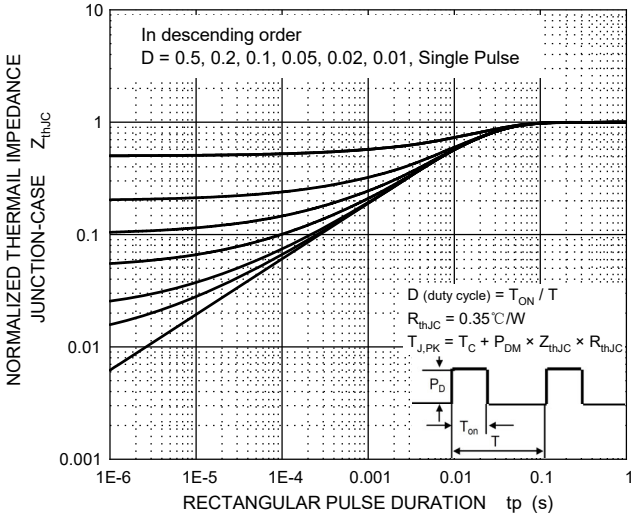

**Drain-Source Breakdown Voltage**




**Maximum Safe Operating Area**

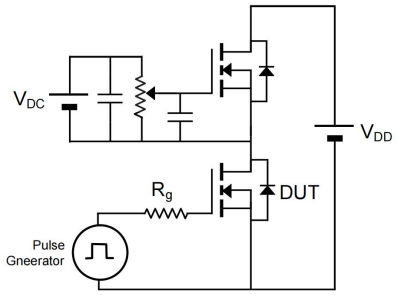


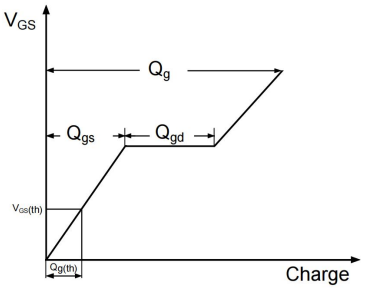

**Transient Thermal Impedance, Junction-Case**



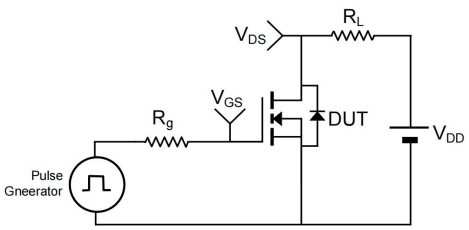
# Test Circuit And Waveforms

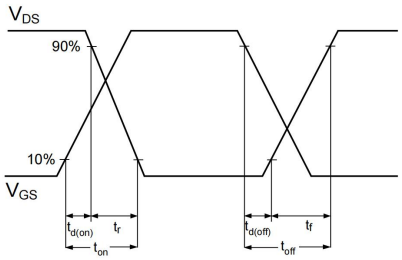
## Gate Charge



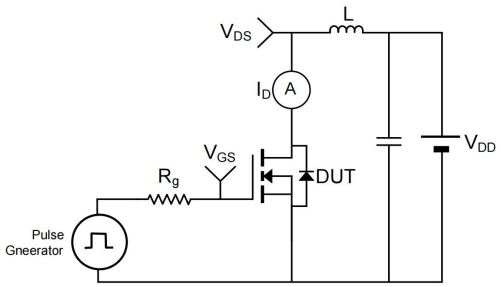



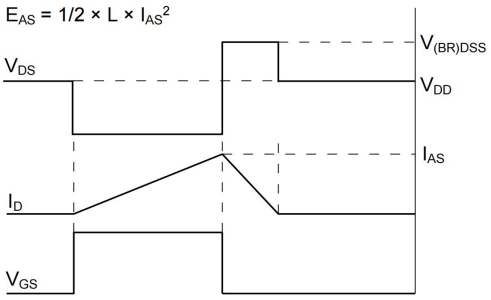

## Resistive Load Switching Time



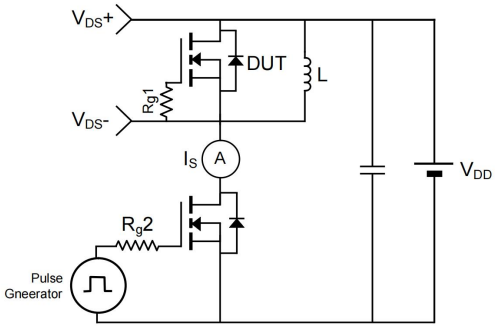



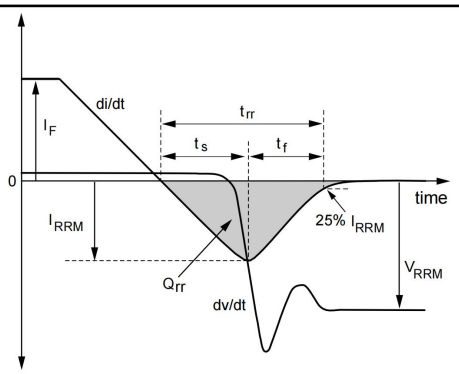

## Un-clamped Inductive Load Switching



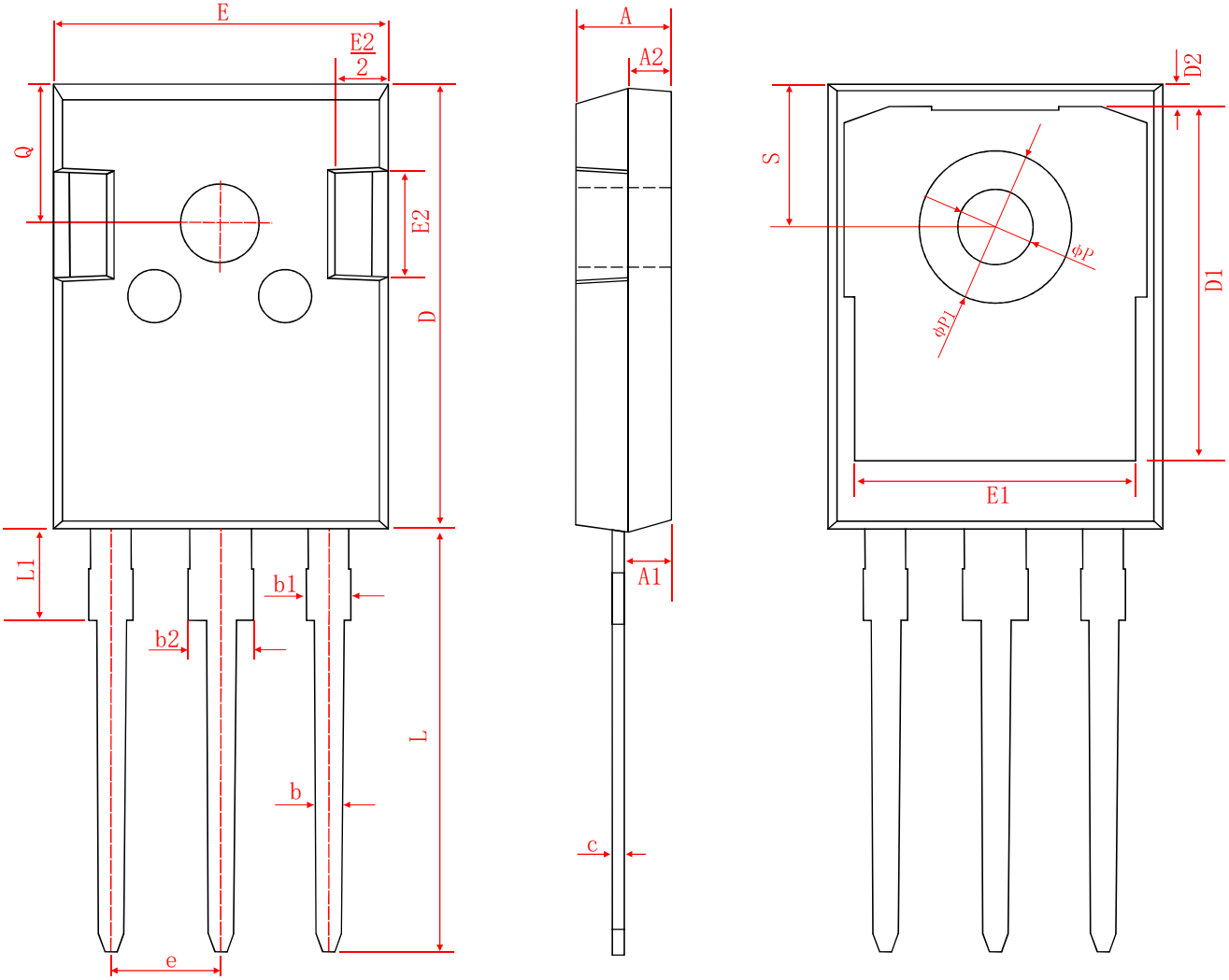




## Drain-Source Body Diode Reverse Recovery



## TO-247-A Package Outline Dimensions




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 4.90 | 5.10 | 0.193 | 0.201 |
| A1 | 2.31 | 2.51 | 0.091 | 0.099 |
| A2 | 1.90 | 2.10 | 0.075 | 0.083 |
| b | 1.15 | 1.25 | 0.045 | 0.049 |
| b1 | 1.95 | 2.25 | 0.077 | 0.089 |
| b2 | 2.95 | 3.25 | 0.116 | 0.128 |
| c | 0.55 | 0.65 | 0.022 | 0.026 |
| D | 20.90 | 21.10 | 0.823 | 0.831 |
| D1 | 16.35 | 16.75 | 0.644 | 0.659 |
| D2 | 1.05 | 1.35 | 0.041 | 0.053 |
| e | 5.44 TYP. | | 0.214 TYP. | |
| E | 15.70 | 15.90 | 0.618 | 0.626 |
| E1 | 13.10 | 13.40 | 0.516 | 0.528 |
| E2 | 4.90 | 5.10 | 0.193 | 0.201 |
| Q | 5.60 | 6.00 | 0.220 | 0.236 |
| S | 6.05 | 6.25 | 0.238 | 0.246 |
| L | 19.80 | 20.15 | 0.780 | 0.793 |
| L1 | | 4.30 | | 0.169 |
| ΦP | 3.45 | 3.65 | 0.136 | 0.144 |
| ΦP1 | 7.03 | 7.33 | 0.277 | 0.289 |