# DMWSH120H28SM3-VB Datasheet
# N-Channel 1200V (D-S) SiC Power MOSFET

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | 1200 | |
| $R_{DS(on)}$ at 25 °C (Ω) | $V_{GS}$ = 18 V | 0.016 |
| $Q_g$ (nC) | 200 | |

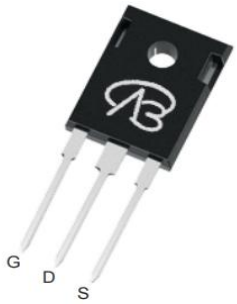
## FEATURES

- Low figure-of-merit (FOM) $R_{on}$ x $Q_g$
- Higher robustness and system reliability
- Kelvin source provides up to 4 times lower switching losses
- Ultra low gate charge ($Q_g$)
- Avalanche energy rated (UIS)

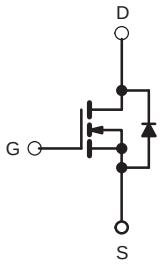
## APPLICATIONS

- Server and telecom power supplies
- EV charging infrastructure
- Solar PV inverters
- DC/DC converter

TO247




Top View




N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25 °C, unless otherwise noted) | | | | | |
|---|---|---|---|---|---|
| PARAMETER | | | SYMBOL | LIMIT | UNIT |
| Drain-Source Voltage | | | $V_{DS}$ | 1200 | V |
| Gate-Source Voltage | | | $V_{GS}$ | -10 / +22 | |
| Continuous Drain Current ($T_J$ = 175 °C) | $V_{GS}$ at 18 V | $T_C$ = 25 °C | $I_D$ | 142 | A |
| | | $T_C$ = 100 °C | | 100 | |
| Pulsed Drain Current [a] | | | $I_{DM}$ | 310 | |
| Linear Derating Factor | | | | 2.1 | W/°C |
| Single Pulse Avalanche Energy [b] | | | $E_{AS}$ | 625 | mJ |
| Maximum Power Dissipation | | | $P_D$ | 535 | W |
| Operating Junction and Storage Temperature Range | | | $T_J$, $T_{stg}$ | -55 to +175 | °C |
| Drain-Source Voltage Slope | $T_J$ = 125 °C | | dV/dt | 150 | V/ns |
| Reverse Diode dV/dt [d] | | | | 100 | |
| Soldering Recommendations (Peak Temperature) [c] | for 10 s | | | 260 | °C |

**Notes**

a. Repetitive rating; pulse width limited by maximum junction temperature.
b. $V_{DD}$ = 50 V, starting $T_J$ = 25 °C, L = 0.5mH, $R_g$ = 25 Ω.
c. 1.6 mm from case.
d. $I_{SD} \leq I_D$, dI/dt = 100 A/μs, starting $T_J$ = 25 °C.

| THERMAL RESISTANCE RATINGS | | | | |
|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TYP.** | **MAX.** | **UNIT** |
| Maximum Junction-to-Ambient | $R_{thJA}$ | - | 62 | °C/W |
| Maximum Junction-to-Case (Drain) | $R_{thJC}$ | - | 0.28 | |

| SPECIFICATIONS ($T_J$ = 25 °C, unless otherwise noted) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **Static** | | | | | | | |
| Drain-Source Breakdown Voltage | $V_{DS}$ | $V_{GS}$ = 0 V, $I_D$ = 1 mA | | 1200 | - | - | V |
| $V_{DS}$ Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to 25 °C, $I_D$ = 1 mA | | - | 0.70 | - | V/°C |
| Gate-Source Threshold Voltage (N) | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 5 mA | | 2 | - | 4 | V |
| Gate-Source Leakage | $I_{GSS}$ | $V_{GS}$ = +18 V | | - | - | 100 | nA |
| | | $V_{GS}$ = - 8 V | | - | - | 100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 1200V, $V_{GS}$ = 0 V | | - | - | 100 | μA |
| | | $V_{DS}$ = 1200 V, $V_{GS}$ = 0 V, $T_J$ = 125 °C | | - | - | 200 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}$ = 18 V | $I_D$ = 100A | - | 0.016 | - | Ω |
| Forward Transconductance | $g_{fs}$ | $V_{DS}$ = 0 V, $I_D$ = 100 A | | - | 50 | - | S |
| **Dynamic** | | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 800 V, f = 100 KHz | | - | 6800 | - | pF |
| Output Capacitance | $C_{oss}$ | | | - | 300 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | - | 15 | - | |
| Effective Output Capacitance, Energy Related [a] | $C_{o(er)}$ | $V_{DS}$ = 0 V to 800 V, $V_{GS}$ = 0 V | | - | 230 | - | |
| Effective Output Capacitance, Time Related [b] | $C_{o(tr)}$ | | | - | 320 | - | |
| Total Gate Charge | $Q_g$ | $V_{GS}$ = -5/18 V | $I_D$ = 50 A, $V_{DS}$ = 800 V | - | 200 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | | - | 80 | - | |
| Gate-Drain Charge | $Q_{gd}$ | | | - | 60 | - | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 800 V, $I_D$ =50A, $V_{GS}$ = -5/18 V | | - | 15 | 20 | ns |
| Rise Time | $t_r$ | | | - | 40 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 60 | - | |
| Fall Time | $t_f$ | | | - | 30 | - | |
| Gate Input Resistance | $R_g$ | f = 1 MHz, open drain | | - | 8.5 | - | Ω |
| **Drain-Source Body Diode Characteristics** | | | | | | | |
| Continuous Source-Drain Diode Current | $I_S$ | MOSFET symbol showing the integral reverse p - n junction diode | | - | - | 60 | A |
| Pulsed Diode Forward Current | $I_{SM}$ | | | - | - | 150 | |
| Diode Forward Voltage | $V_{SD}$ | $T_J$ = 25 °C, $I_S$ = 50 A, $V_{GS}$ = 0 | | - | - | 4.1 | V |
| Reverse Recovery Time | $t_{rr}$ | $T_J$ = 25 °C, $I_F$ = $I_S$ = 50 A, dI/dt = 1000 A/μs, $V_R$ = 800 V | | - | 35 | - | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | | - | 1.5 | - | μC |
| Reverse Recovery Current | $I_{RRM}$ | | | - | 15 | - | A |

**Notes**

a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as $C_{oss}$ while $V_{DS}$ is rising from 0 % to 60 % $V_{DSS}$.

b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 % to 60 % $V_{DSS}$.

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

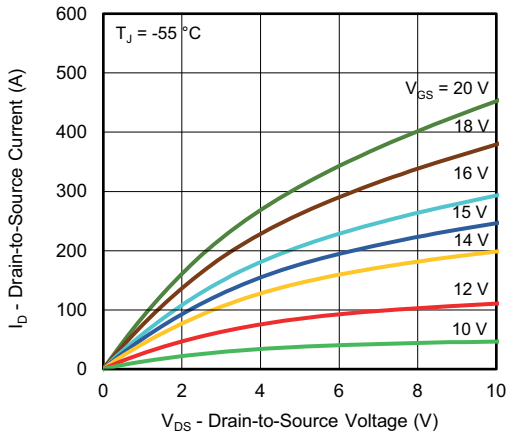



**Fig. 1 - Typical Output Characteristics**

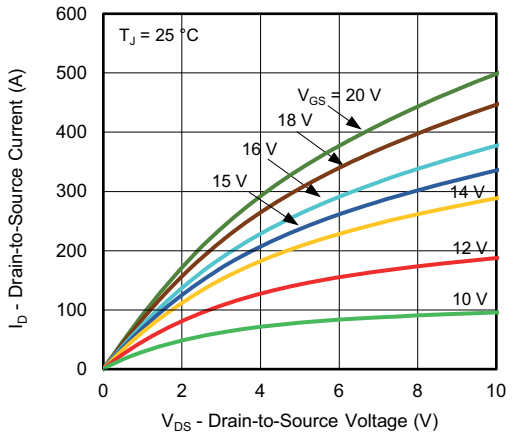



**Fig. 2 - Typical Output Characteristics**

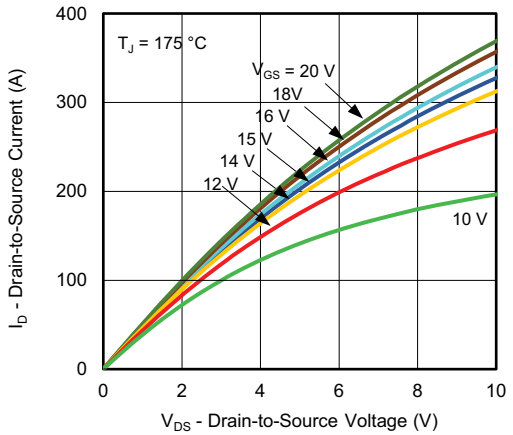



**Fig. 3 - Typical Output Characteristics**

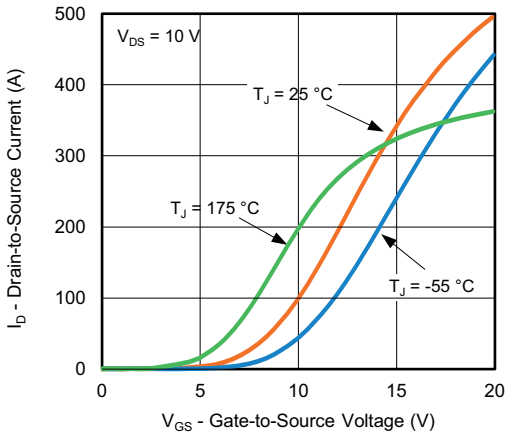



**Fig. 4 - Typical Transfer Characteristics**

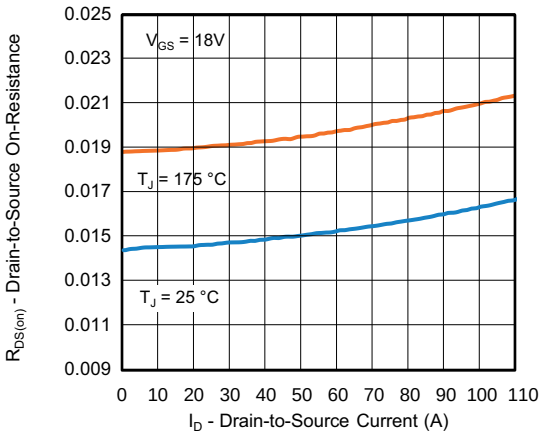



**Fig. 5 - Normalized On-Resistance vs. Drain Current**

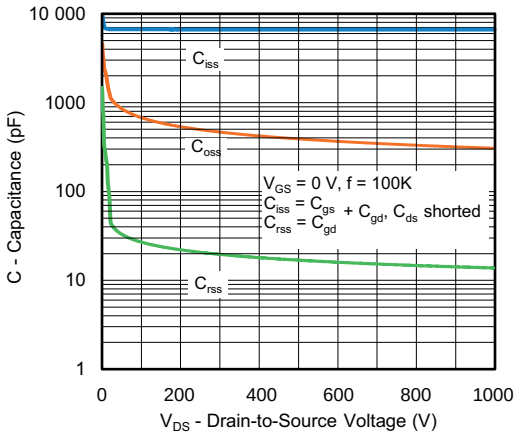



**Fig. 6 - Typical Capacitance vs. Drain-to-Source Voltage**

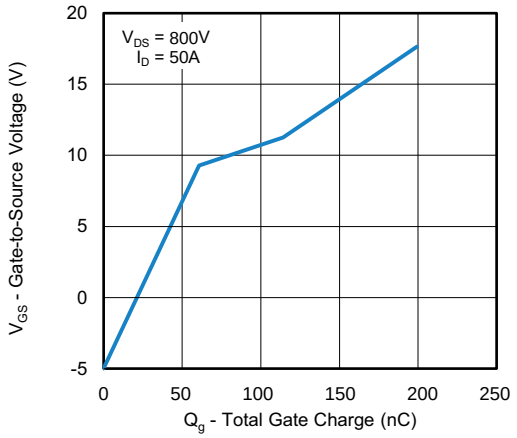



**Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage**

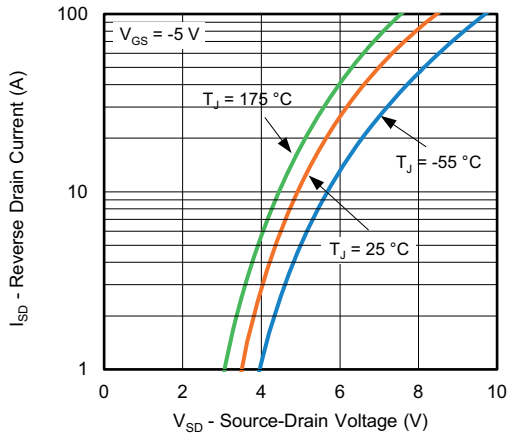



**Fig. 10 - Typical Source-Drain Diode Forward Voltage**

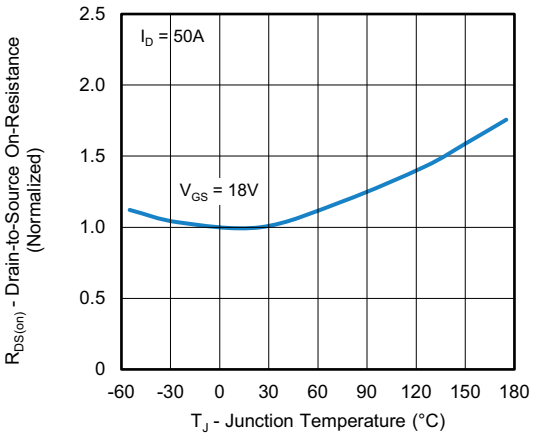



**Fig. 8 - Normalized On-Resistance vs. Temperature**

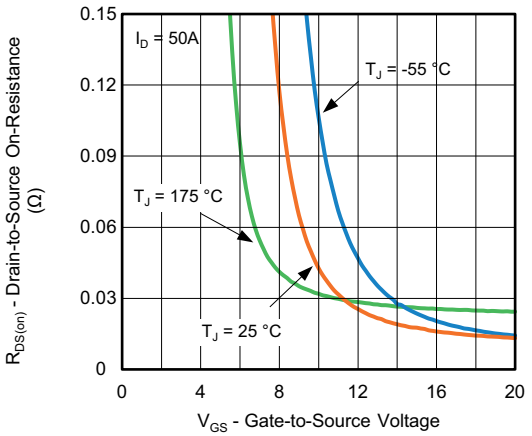



**Fig. 11 - On-Resistance vs. Gate-to-Source Voltage**

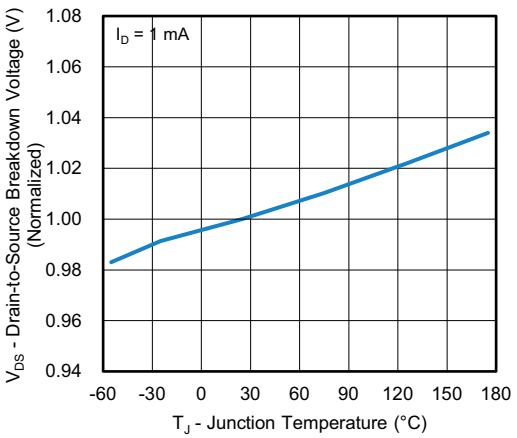



**Fig. 9 - Drain-to-Source Voltage vs. Temperature**

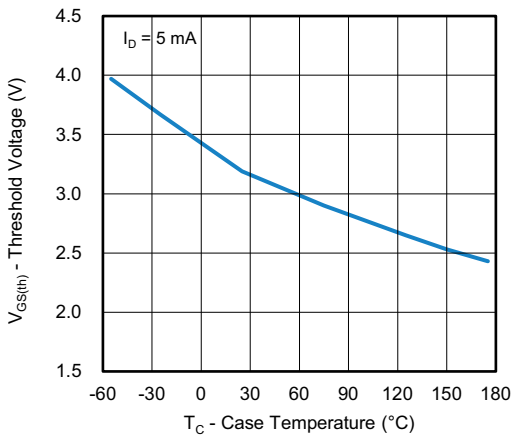



**Fig. 12 - Threshold Voltage vs. Case Temperature**

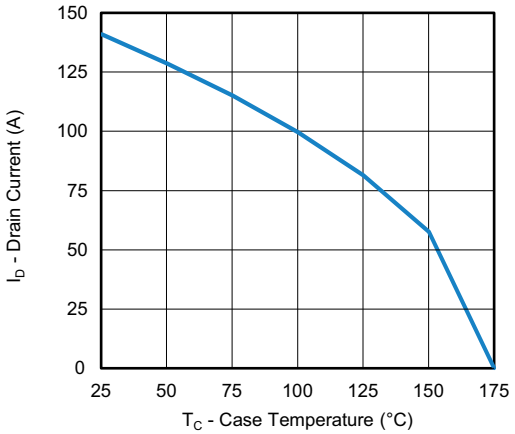



**Fig. 13 - Drain Current vs. Case Temperature**

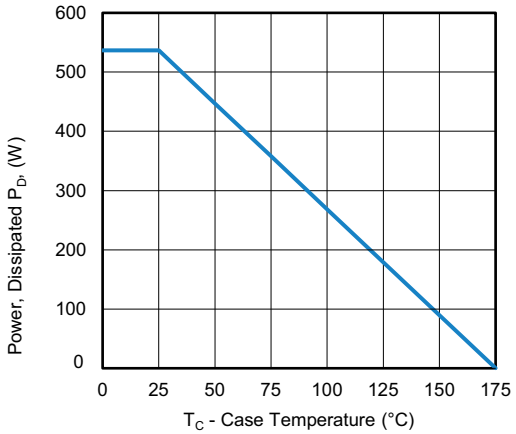



**Fig. 15 - Power, Dissipated $P_D$ vs. Case Temperature**

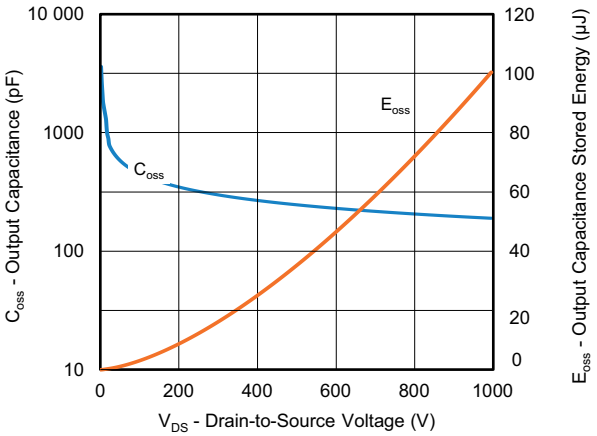



**Fig. 14 - Output Capacitance and its Stored Energy vs. Drain-to-Source Voltage**

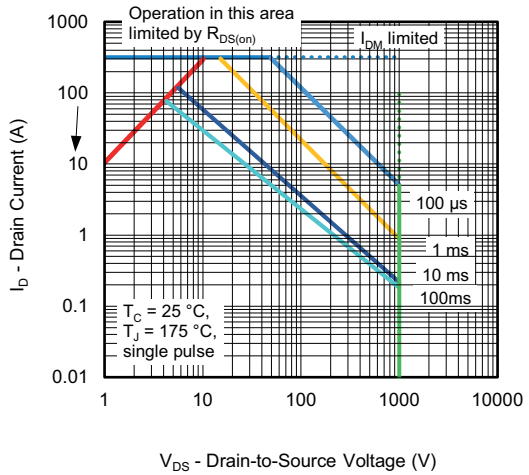



**Fig. 16 - Safe Operating Area**

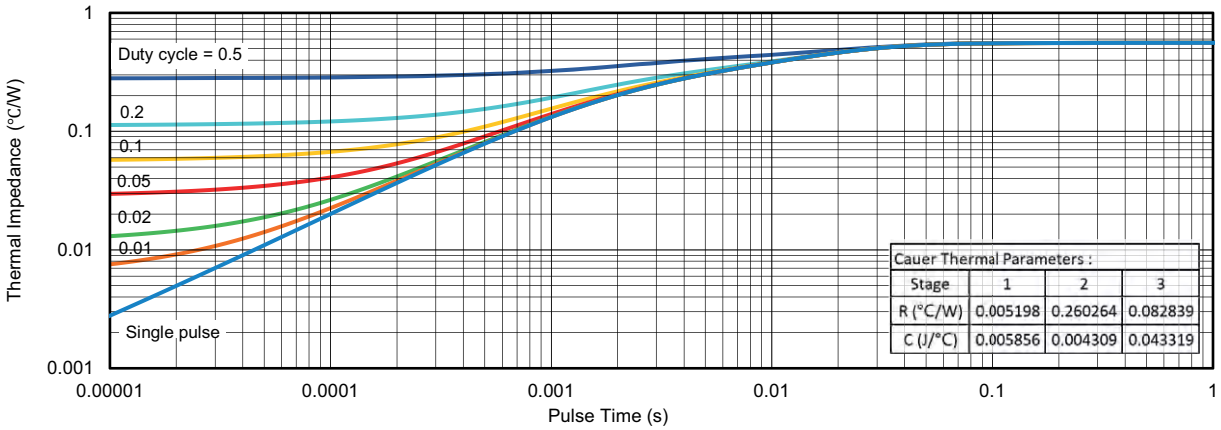



**Fig. 17 - Transient Thermal Impedance**

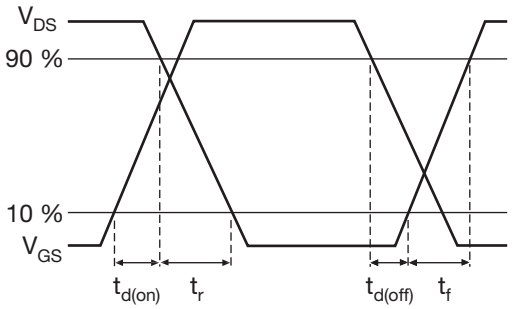



**Fig. 18 - Waveforms of Switching Time**

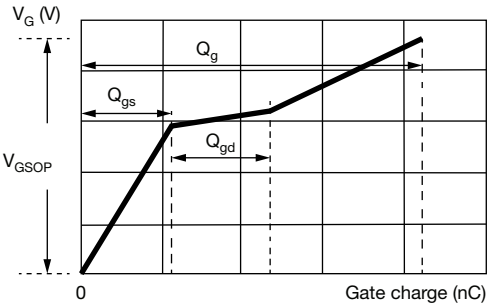



**Fig. 21 - Waveforms for Gate Charge**

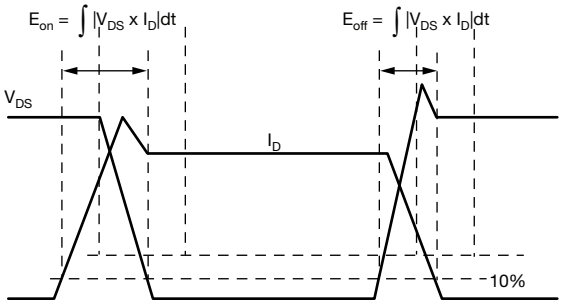



**Fig. 19 - Waveforms for Switching Energy**

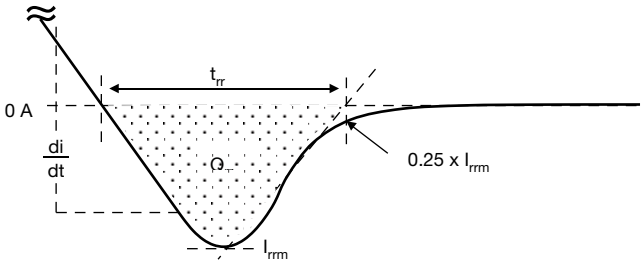



**Fig. 22 - Waveforms for Reverse Recovery**

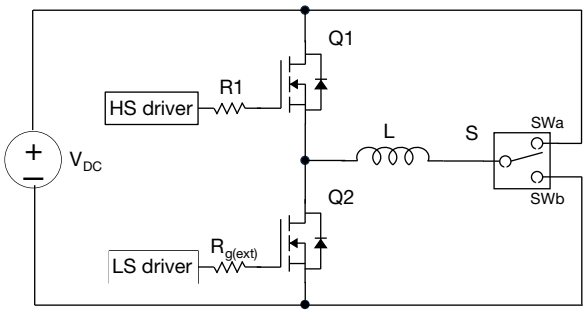



**Fig. 20 - Switching and Reverse Diode Characteristics Measurement Circuit**

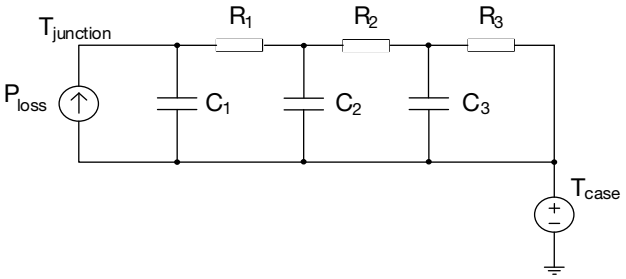
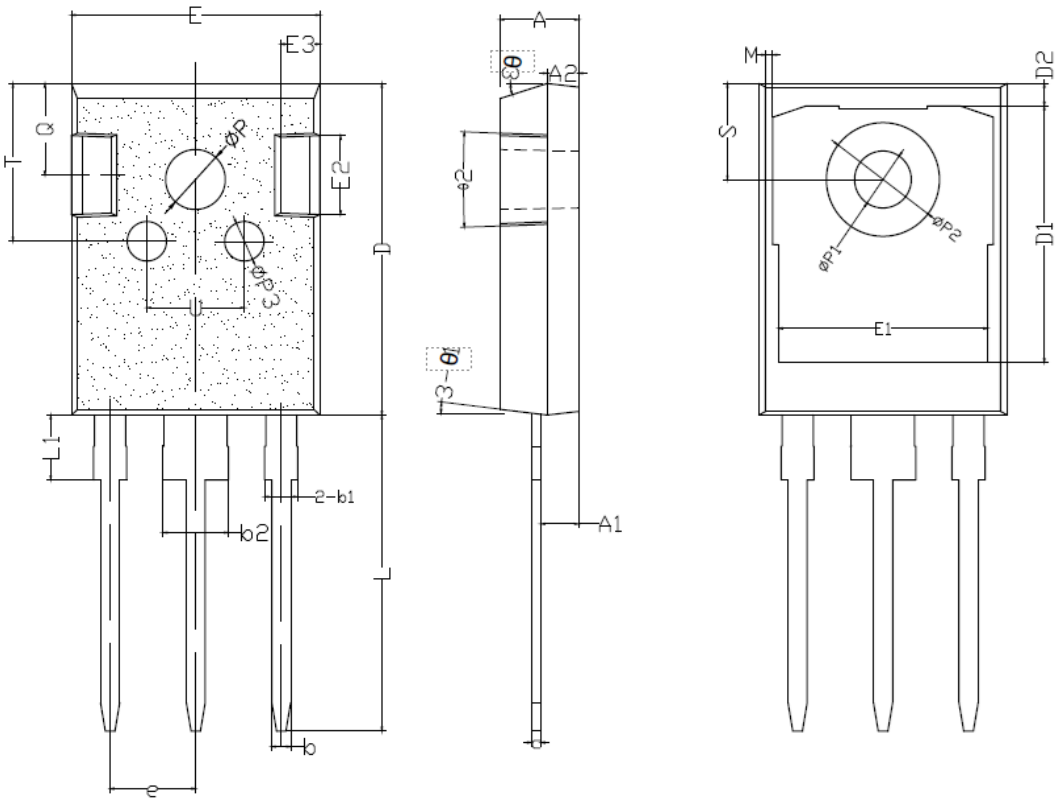
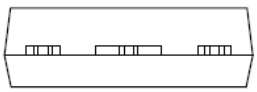



**Fig. 23 - Thermal Equivalent Circuit**

## TO-247 PACKAGE OUTLINE DIMENSIONS



| SYMBOL | mm | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| *A | 4.90 | 5.00 | 5.10 |
| *A1 | 2.31 | 2.41 | 2.51 |
| A2 | 1.90 | 2.00 | 2.10 |
| *b | 1.15 | 1.20 | 1.25 |
| *b1 | 1.95 | 2.10 | 2.25 |
| *b2 | 2.95 | 3.10 | 3.25 |
| *c | 0.55 | 0.60 | 0.65 |
| *D | 20.90 | 21.00 | 21.10 |
| D1 | 16.35 | 16.55 | 16.75 |
| D2 | 1.05 | 1.20 | 1.35 |

| | | | |
|---|---|---|---|
| *E | 15.70 | 15.80 | 15.90 |
| E1 | 13.10 | 13.25 | 13.40 |
| E2 | 4.85 | 4.95 | 5.10 |
| E3 | 2.40 | 2.50 | 2.60 |
| *e | 5.40 | 5.44 | 5.48 |
| *L | 19.80 | 19.98 | 20.15 |
| *L1 | - | - | 4.30 |
| *ΦP | 3.40 | 3.50 | 3.60 |
| *ΦP1 | 6.90 | 7.10 | 7.30 |
| ΦP2 | 2.40 | 2.50 | 2.60 |
| ΦP3 | 2.40 | 2.50 | 2.60 |
| Q | 5.60 | 5.80 | 6.00 |
| *S | 6.05 | 6.15 | 6.25 |
| T | 9.80 | 10.00 | 10.20 |
| U | 6.00 | 6.20 | 6.40 |
| θ1 | 5° | 7° | 9° |
| θ2 | 1° | 3° | 5° |
| θ3 | 13° | 15° | 17° |
| | | | |

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