

SCT4018KR-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 | 0.015 |
| Q_g (nC) | 200 | |

FEATURES

- Low figure-of-merit (FOM) $R_{on} \times Q_g$
- 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

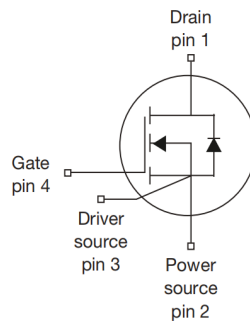
- Server and telecom power supplies
- EV charging infrastructure
- Solar PV inverters
- DC/DC converter

TO247-4L



Top View

- Pin1 D - Drain
- Pin2 S - Source(Power)
- Pin3 S - Source(Driver)
- Pin4 G - Gate



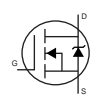
N-Channel MOSFET

| 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 | 142 |
| | | $T_C = 100$ °C | 100 |
| Pulsed Drain Current ^a | | I_{DM} | 310 |
| Linear Derating Factor | | | 2.1 |
| Single Pulse Avalanche Energy ^b | | E_{AS} | 625 |
| Maximum Power Dissipation | | P_D | 535 |
| Operating Junction and Storage Temperature Range | | T_J, T_{stg} | -55 to +175 |
| Drain-Source Voltage Slope | | dV/dt | 150 |
| Reverse Diode dV/dt ^d | $T_J = 125$ °C | | |
| Soldering Recommendations (Peak Temperature) ^c | | for 10 s | 260 |
| | | | °C |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 0.5$ mH, $R_g = 25$ Ω .
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, 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 ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | | | | | |
|---|---------------------|---|--|------|-------|------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$ | | 1200 | - | - | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$ | | - | 0.70 | - | V/°C |
| Gate-Source Threshold Voltage (N) | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 5\text{ mA}$ | | 2 | - | 4 | V |
| Gate-Source Leakage | I_{GSS} | $V_{GS} = +18\text{ V}$ | | - | - | 100 | nA |
| | | $V_{GS} = -8\text{ V}$ | | - | - | 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$ | | - | - | 100 | μA |
| | | $V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | | - | - | 200 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = 18\text{ V}$ | $I_D = 100\text{ A}$ | - | 0.015 | - | Ω |
| Forward Transconductance | g_{fs} | $V_{DS} = 0\text{ V}, I_D = 100\text{ A}$ | | - | 50 | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V},$ $V_{DS} = 800\text{ V},$ $f = 100\text{ KHz}$ | | - | 6800 | - | pF |
| Output Capacitance | C_{oss} | | | - | 300 | - | |
| Reverse Transfer Capacitance | C_{rss} | | | - | 15 | - | |
| Effective Output Capacitance, Energy Related ^a | $C_{o(er)}$ | $V_{DS} = 0\text{ V to } 800\text{ V}, V_{GS} = 0\text{ V}$ | | - | 230 | - | |
| Effective Output Capacitance, Time Related ^b | $C_{o(tr)}$ | | | - | 320 | - | |
| Total Gate Charge | Q_g | $V_{GS} = -5/18\text{ V}$ | $I_D = 50\text{ A}, V_{DS} = 800\text{ V}$ | - | 200 | - | nC |
| Gate-Source Charge | Q_{gs} | | | - | 80 | - | |
| Gate-Drain Charge | Q_{gd} | | | - | 60 | - | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 800\text{ V}, I_D = 50\text{ A}$ $V_{GS} = -5/18\text{ V}$ | | - | 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 | $f = 1\text{ MHz}, \text{ open drain}$ | | - | 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} | $T_J = 25\text{ }^\circ\text{C}, I_S = 50\text{ A}, V_{GS} = 0$ | | - | - | 4.1 | V |
| Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 50\text{ A},$ $di/dt = 1000\text{ A}/\mu\text{s}, V_R = 800\text{ V}$ | | - | 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)

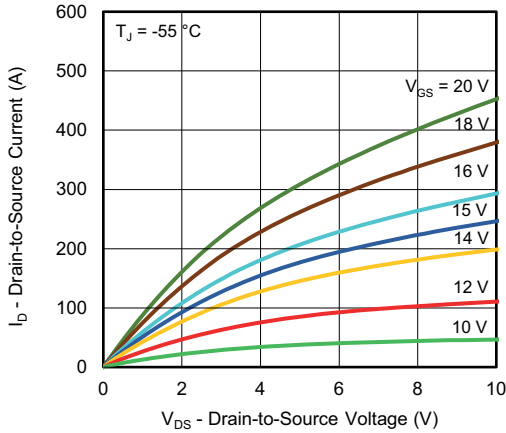


Fig. 1 - Typical Output Characteristics

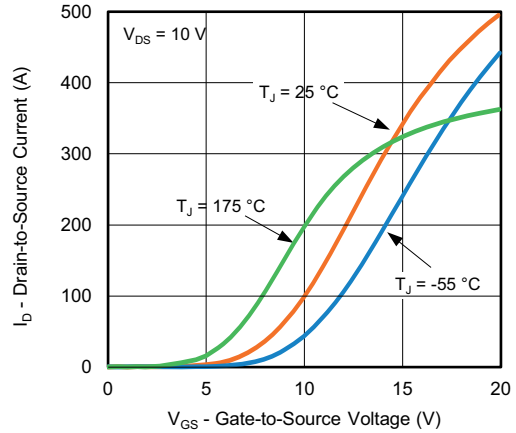


Fig. 4 - Typical Transfer Characteristics

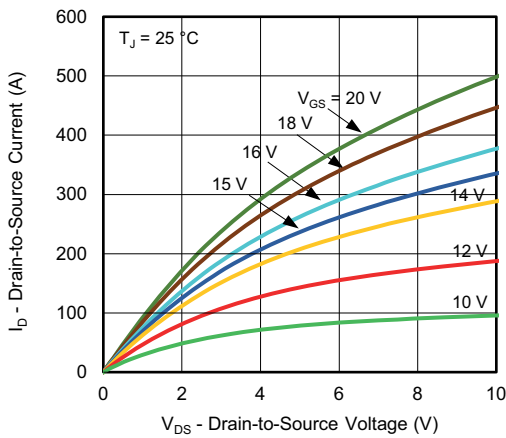


Fig. 2 - Typical Output Characteristics



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

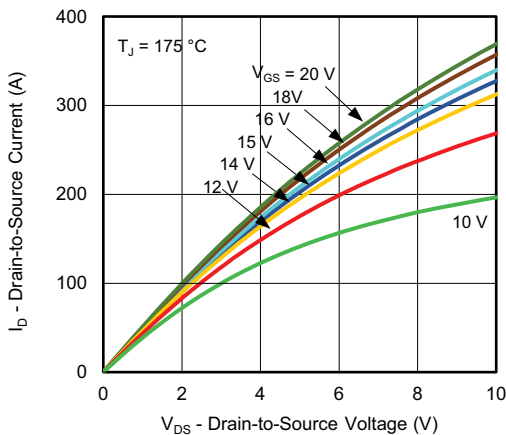


Fig. 3 - Typical Output Characteristics

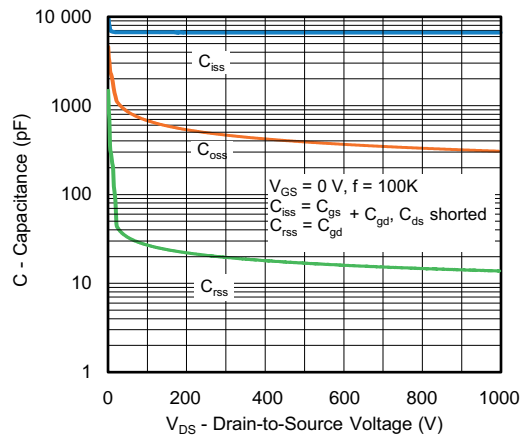


Fig. 6 - Typical Capacitance vs. Drain-to-Source Voltage

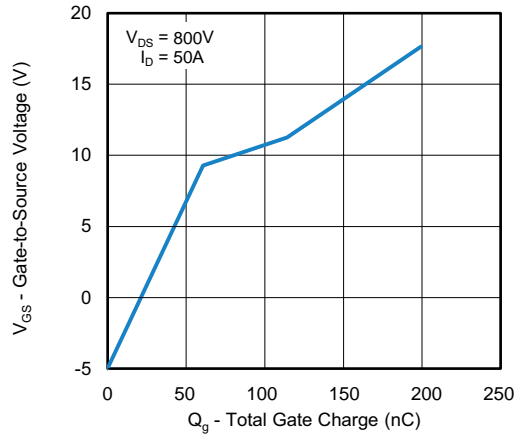


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

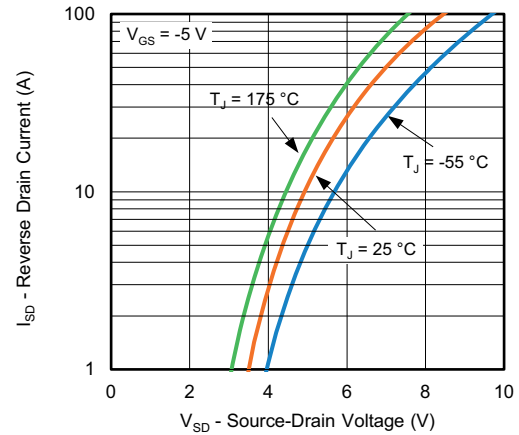


Fig. 10 - Typical Source-Drain Diode Forward Voltage

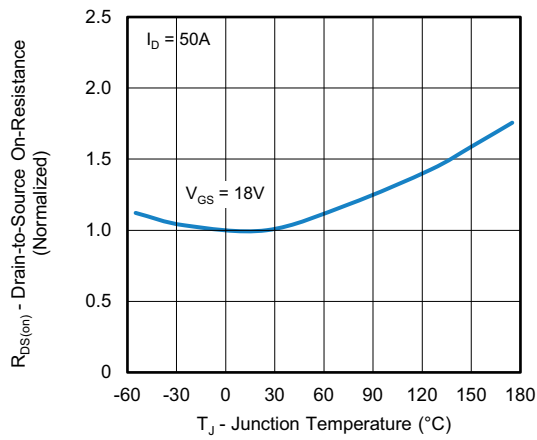


Fig. 8 - Normalized On-Resistance vs. Temperature

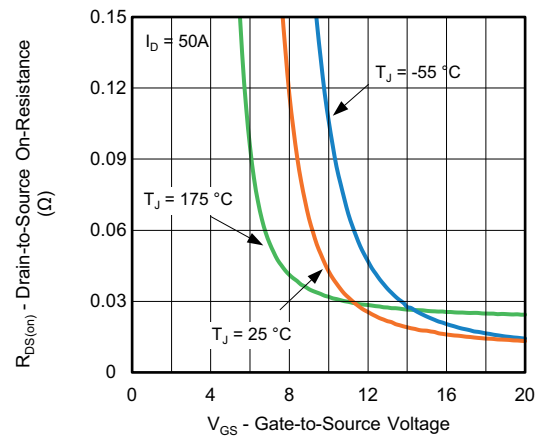


Fig. 11 - On-Resistance vs. Gate-to-Source Voltage

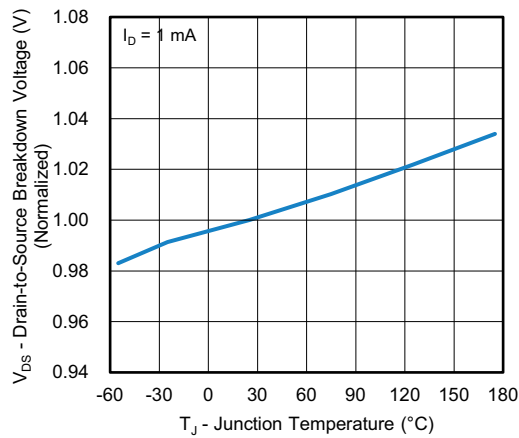


Fig. 9 - Drain-to-Source Voltage vs. Temperature

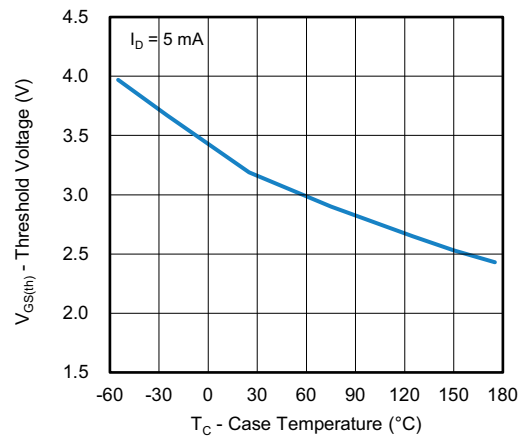


Fig. 12 - Threshold Voltage vs. Case Temperature

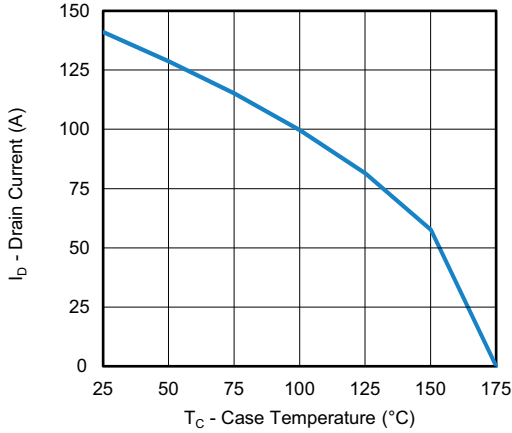


Fig. 13 - Drain Current vs. Case Temperature

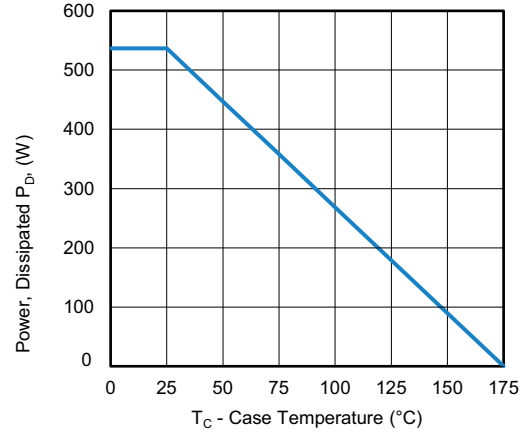


Fig. 15 - Power, Dissipated P_D vs. Case Temperature

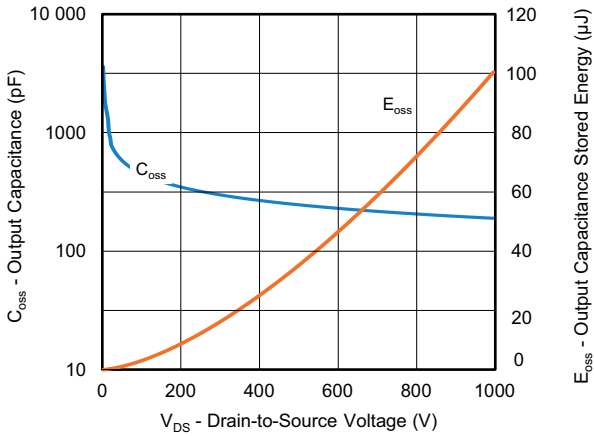


Fig. 14 - Output Capacitance and its Stored Energy vs. Drain-to-Source Voltage

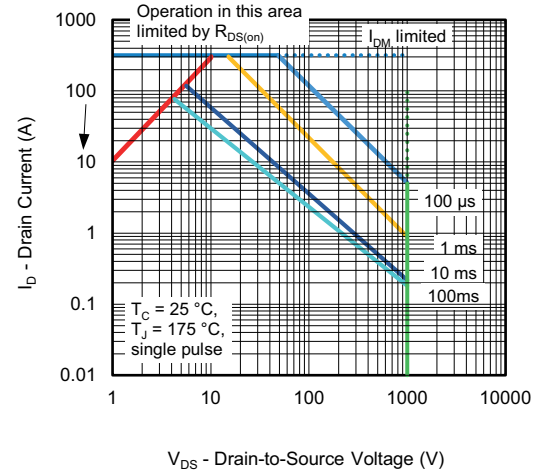


Fig. 16 - Safe Operating Area

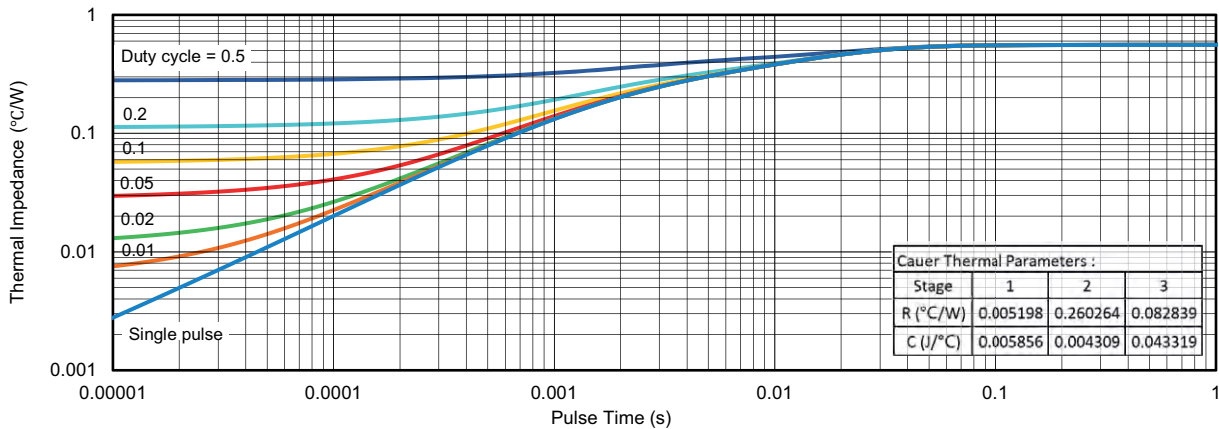


Fig. 17 - Transient Thermal Impedance

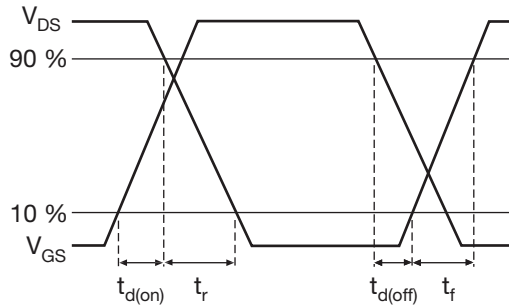


Fig. 18 - Waveforms of Switching Time

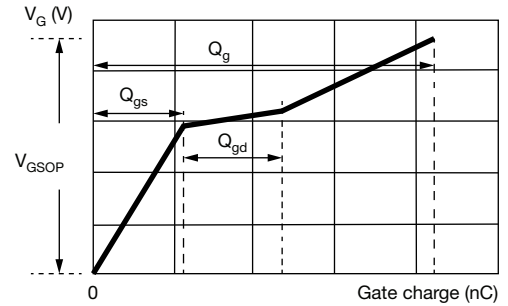


Fig. 21 - Waveforms for Gate Charge

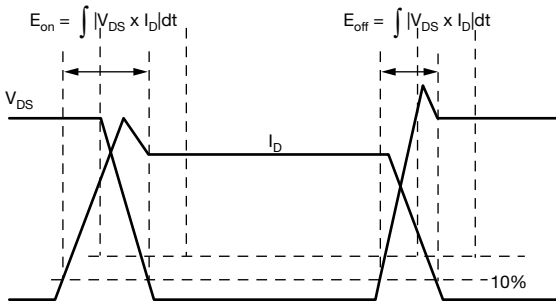


Fig. 19 - Waveforms for Switching Energy

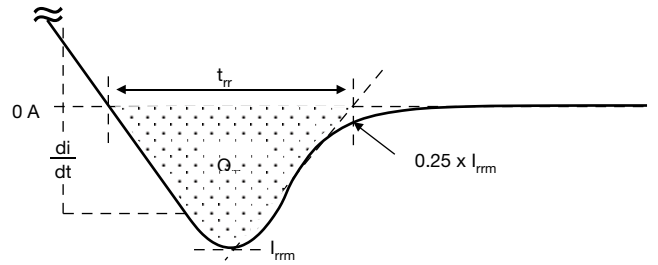


Fig. 22 - Waveforms for Reverse Recovery

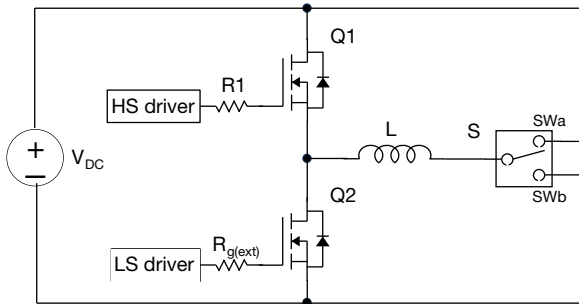


Fig. 20 - Switching and Reverse Diode Characteristics Measurement Circuit

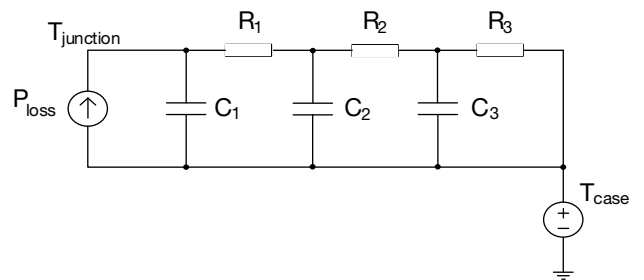
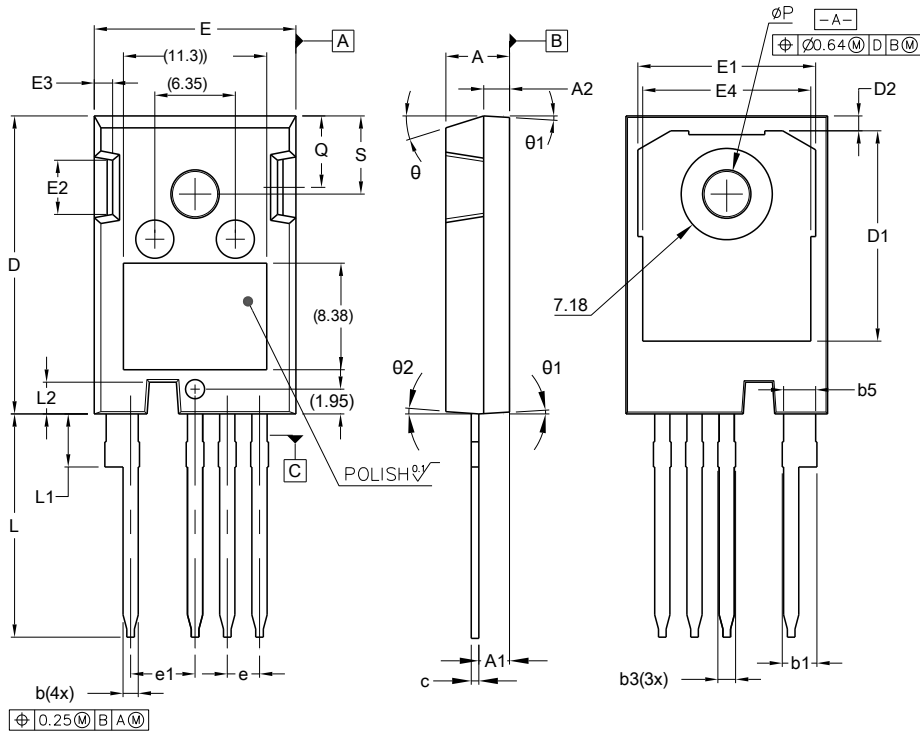


Fig. 23 - Thermal Equivalent Circuit

TO247-4L Package Outline Dimensions



| TO247-4 Standard | | |
|----------------------|-----------------|-------|
| Dim | Min | Max |
| A | 4.83 | 5.21 |
| A1 | 2.29 | 2.54 |
| A2 | 1.91 | 2.16 |
| b | 1.07 | 1.33 |
| b1 | 2.39 | 2.94 |
| b3 | 1.07 | 1.60 |
| b5 | 2.39 | 2.69 |
| c | 0.55 | 0.68 |
| D | 23.30 | 23.60 |
| D1 | 16.25 | 17.65 |
| D2 | 0.95 | 1.25 |
| E | 15.75 | 16.30 |
| E1 | 13.10 | 14.15 |
| E2 | 3.68 | 5.10 |
| E3 | 1.00 | 1.90 |
| E4 | 12.38 | 13.43 |
| e | 2.54 BSC | |
| e1 | 5.08 BSC | |
| L | 17.31 | 17.82 |
| L1 | 3.97 | 4.37 |
| L2 | 2.35 | 2.65 |
| ØP | 3.51 | 3.65 |
| Q | 5.49 | 6.00 |
| S | 6.04 | 6.30 |
| θ | 17.5° - 20° REF | |
| θ1 | 3.5° - 5° REF | |
| θ2 | 4° - 5° REF | |
| All Dimensions in mm | | |

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