# SCT4090KRHR-VB Datasheet
# N-Channel 1200 V (D-S) SiC Power MOSFET

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | 1200 | |
| $R_{DS(on)}$ at 25 °C (Ω) | $V_{GS}$ = 18 V | 0.080 |
| $Q_g$ (nC) | 108 | |

## FEATURES

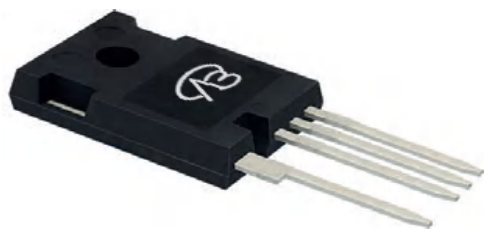
- Low figure-of-merit (FOM) $R_{on}$ x $Q_g$
- Low input capacitance ($C_{iss}$)
- Reduced switching and conduction losses
- Ultra low gate charge ($Q_g$)
- Avalanche energy rated (UIS)

RoHS

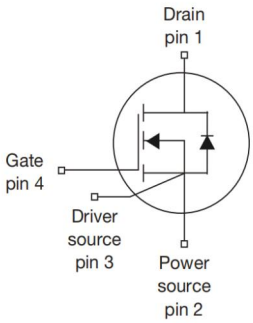
## APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- DC/DC converter

TO-247-4L



•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 ($T_J$ = 150 °C) | $V_{GS}$ at 18 V | $T_C$ = 25 °C | $I_D$ | 30 | A |
| | | $T_C$ = 100 °C | | 21 | |
| Pulsed Drain Current [a] | | | $I_{DM}$ | 90 | |
| Linear Derating Factor | | | | 2.1 | W/°C |
| Single Pulse Avalanche Energy [b] | | | $E_{AS}$ | 1200 | mJ |
| Maximum Power Dissipation | | | $P_D$ | 320 | 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 | 50 | V/ns |
| Reverse Diode dV/dt [d] | | | | 15 | |
| Soldering Recommendations (Peak Temperature) [c] | for 10 s | | | 260 | °C |

**Notes**

a. Repetitive rating; pulse width limited by maximum junction temperature.
b. $V_{DD}$ = 100 V, starting $T_J$ = 25 °C, L = 30mH, $R_g$ = 25 Ω, $I_{AS}$ = 9A.
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 | $R_{thJA}$ | - | 40 | °C/W |
| Maximum Junction-to-Case (Drain) | $R_{thJC}$ | - | 0.47 | |

| 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) | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 10 mA | | 2.5 | - | 4.5 | V |
| Gate-Source Leakage | $I_{GSS}$ | $V_{GS}$ = +22 V | | - | - | 100 | nA |
| | | $V_{GS}$ = -10 V | | - | - | 100 | µA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 1200 V, $V_{GS}$ = 0 V | | - | 10 | - | µA |
| | | $V_{DS}$ = 1200 V, $V_{GS}$ = 0 V, $T_J$ = 125 °C | | - | - | 100 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}$ = 18 V | $I_D$ = 30A | - | 0.080 | - | Ω |
| Forward Transconductance | $g_{fs}$ | $V_{DS}$ = 0 V, $I_D$ = 30 A | | - | 16 | - | S |
| **Dynamic** | | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 800 V, f = 1 MHz | | - | 2800 | - | pF |
| Output Capacitance | $C_{oss}$ | | | - | 123 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | - | 10 | - | |
| Effective Output Capacitance, Energy Related [a] | $C_{o(er)}$ | $V_{DS}$ = 0 V to 800 V, $V_{GS}$ = 0 V | | - | 156 | - | |
| Effective Output Capacitance, Time Related [b] | $C_{o(tr)}$ | | | - | 268 | - | |
| Total Gate Charge | $Q_g$ | $V_{GS}$ = -5/18 V | $I_D$ = 20 A, $V_{DS}$ = 800 V | - | 108 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | | - | 29 | - | |
| Gate-Drain Charge | $Q_{gd}$ | | | - | 33 | - | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 800 V, $I_D$ = 20A, $V_{GS}$ = -5/18 V , $R_g$ = 2 Ω | | - | 18 | 25 | ns |
| Rise Time | $t_r$ | | | - | 24 | 55 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 80 | - | |
| Fall Time | $t_f$ | | | - | 12 | - | |
| Gate Input Resistance | $R_g$ | f = 1 MHz, open drain | | - | 3.2 | - | Ω |
| **Drain-Source Body Diode Characteristics** | | | | | | | |
| Continuous Source-Drain Diode Current | $I_S$ | MOSFET symbol showing the integral reverse p - n junction diode | | - | - | 30 | A |
| Pulsed Diode Forward Current | $I_{SM}$ | | | - | - | 90 | |
| Diode Forward Voltage | $V_{SD}$ | $T_J$ = 25 °C, $I_S$ = 30 A, $V_{GS}$ = 0 | | - | - | 4.1 | V |
| Reverse Recovery Time | $t_{rr}$ | $T_J$ = 25 °C, $I_F$ = $I_S$ = 30 A, dI/dt = 1000 A/µs, $V_R$ = 800 V | | - | 70 | - | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | | - | 220 | - | µC |
| Reverse Recovery Current | $I_{RRM}$ | | | - | 60 | - | 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 80 % $V_{DSS}$.
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 80 % $V_{DSS}$.

Safe operating area Tc=25 ℃
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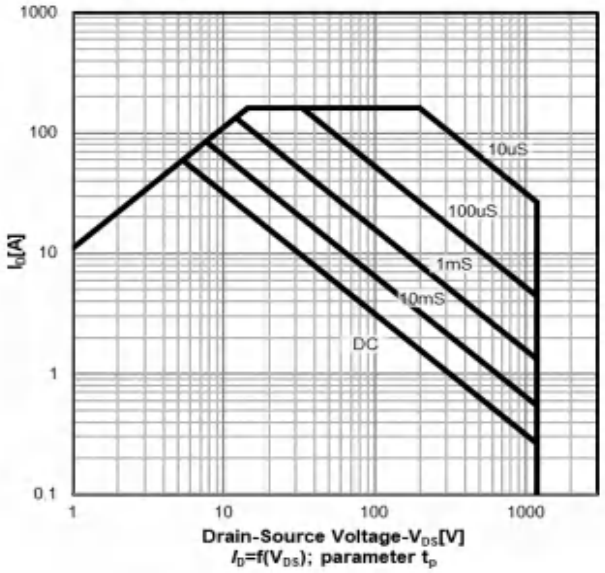
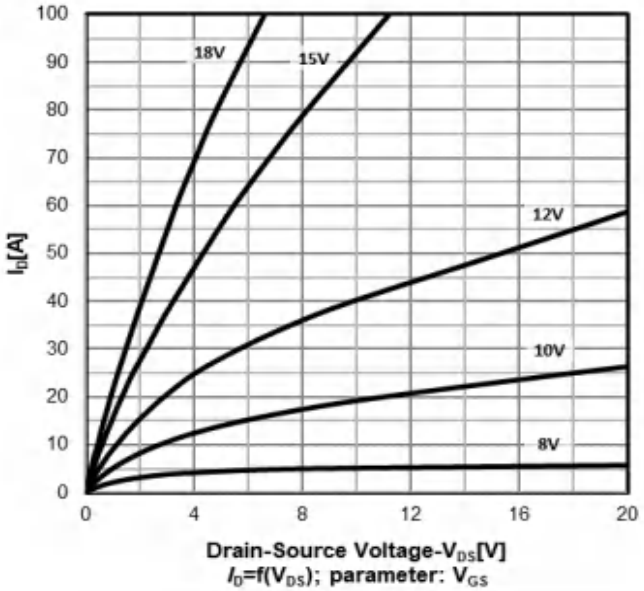
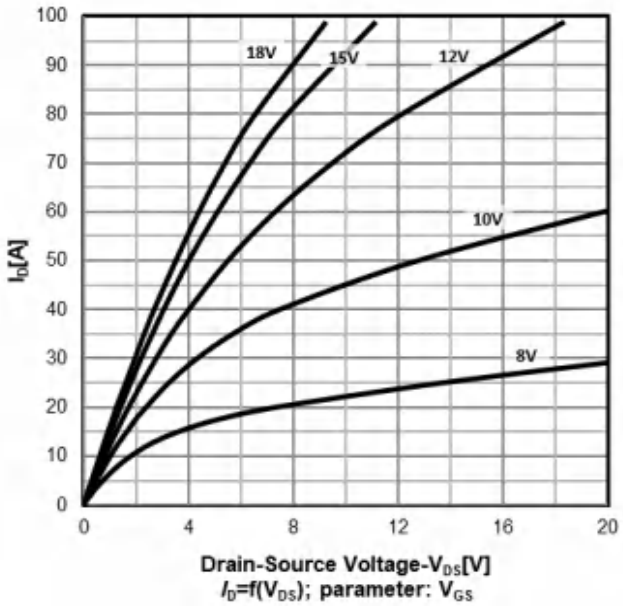


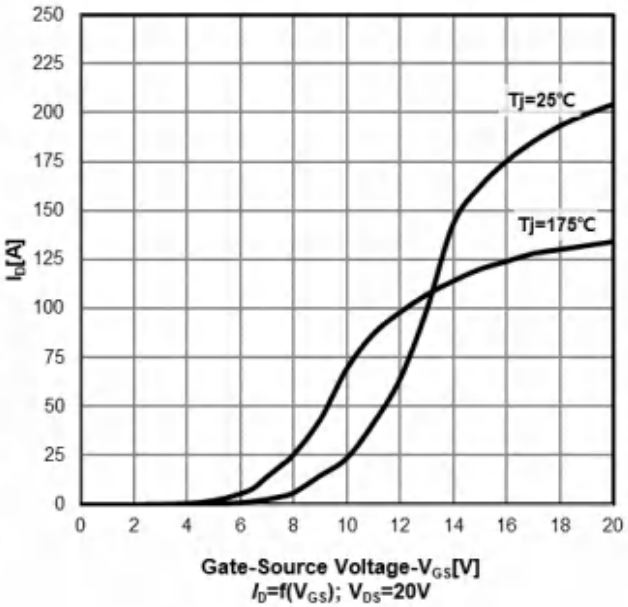

On-Region characteristics Tj=25 ℃



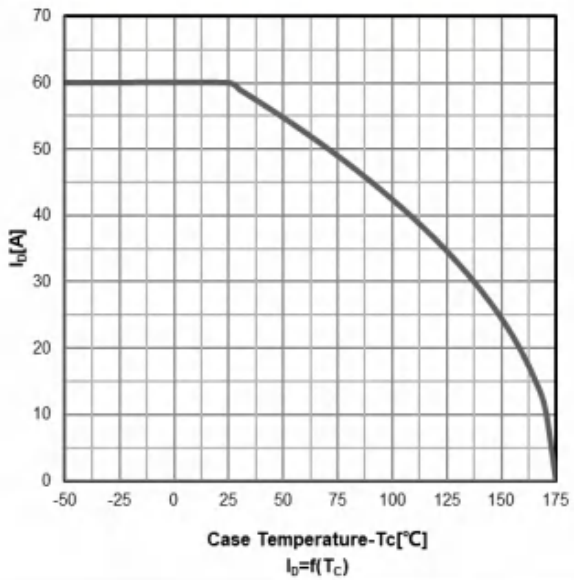

On-Region characteristics Tj=175 ℃



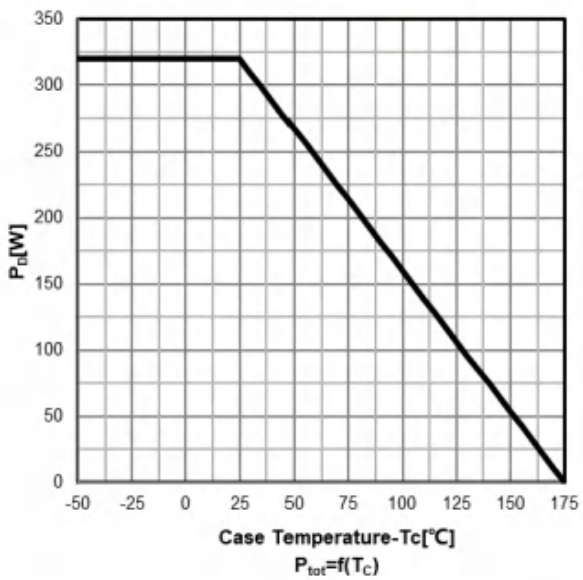

Transfer characteristics



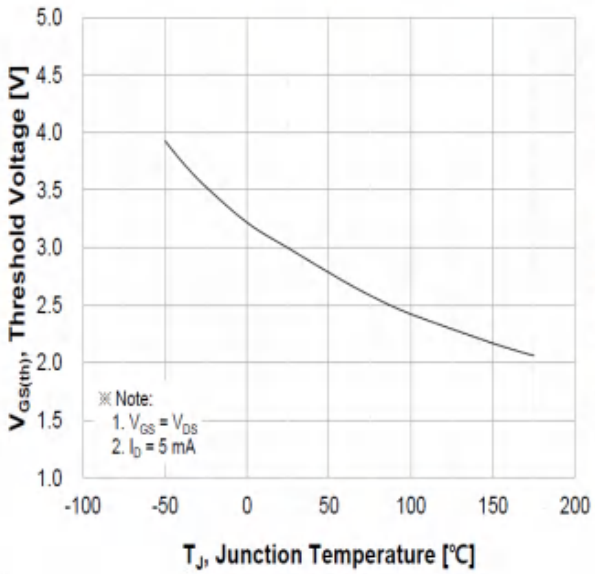
Drain current vs temperature



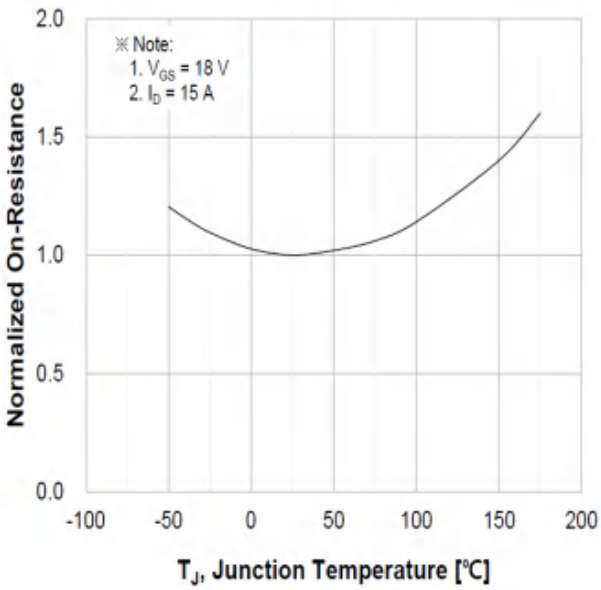

Power dissipation



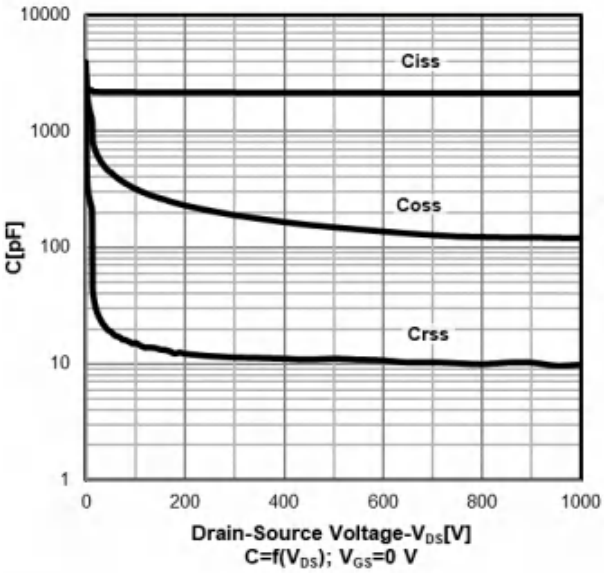

Threshold voltage vs temperature



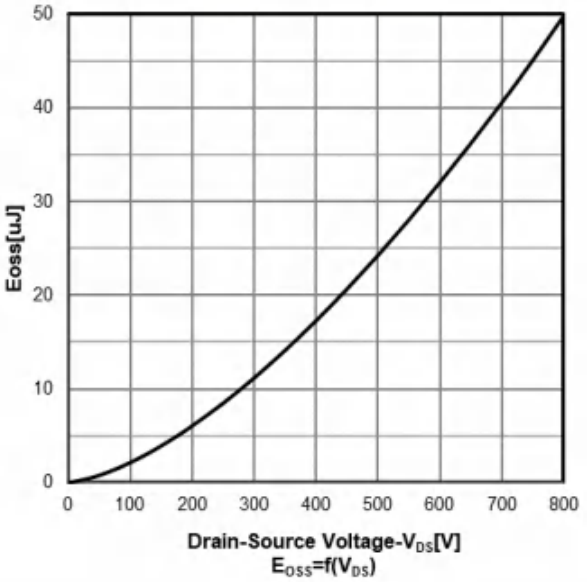

Normalized On-resistance vs temperature



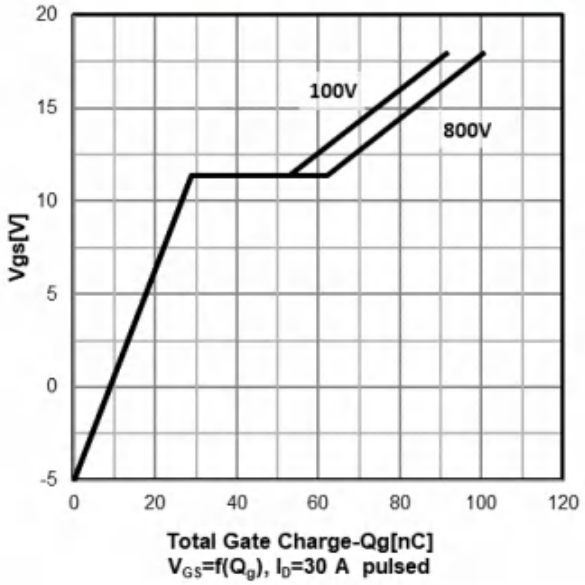
Typ. capacitances



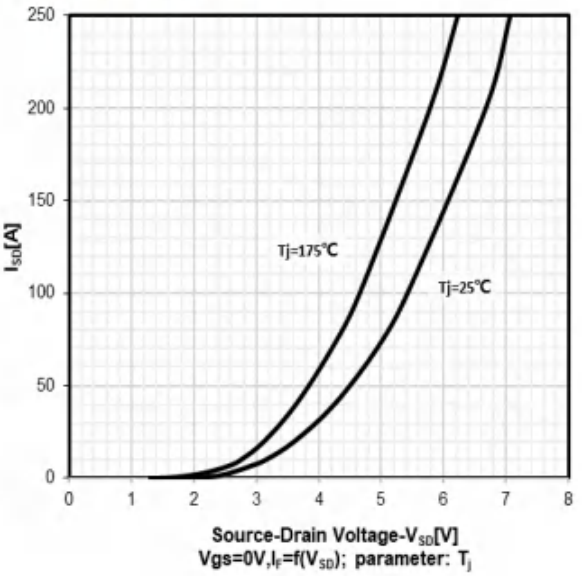

Coss stored energy




Typ. gate charge characteristics




Diode forward voltage characteristics
Tj=25 ℃/175 ℃



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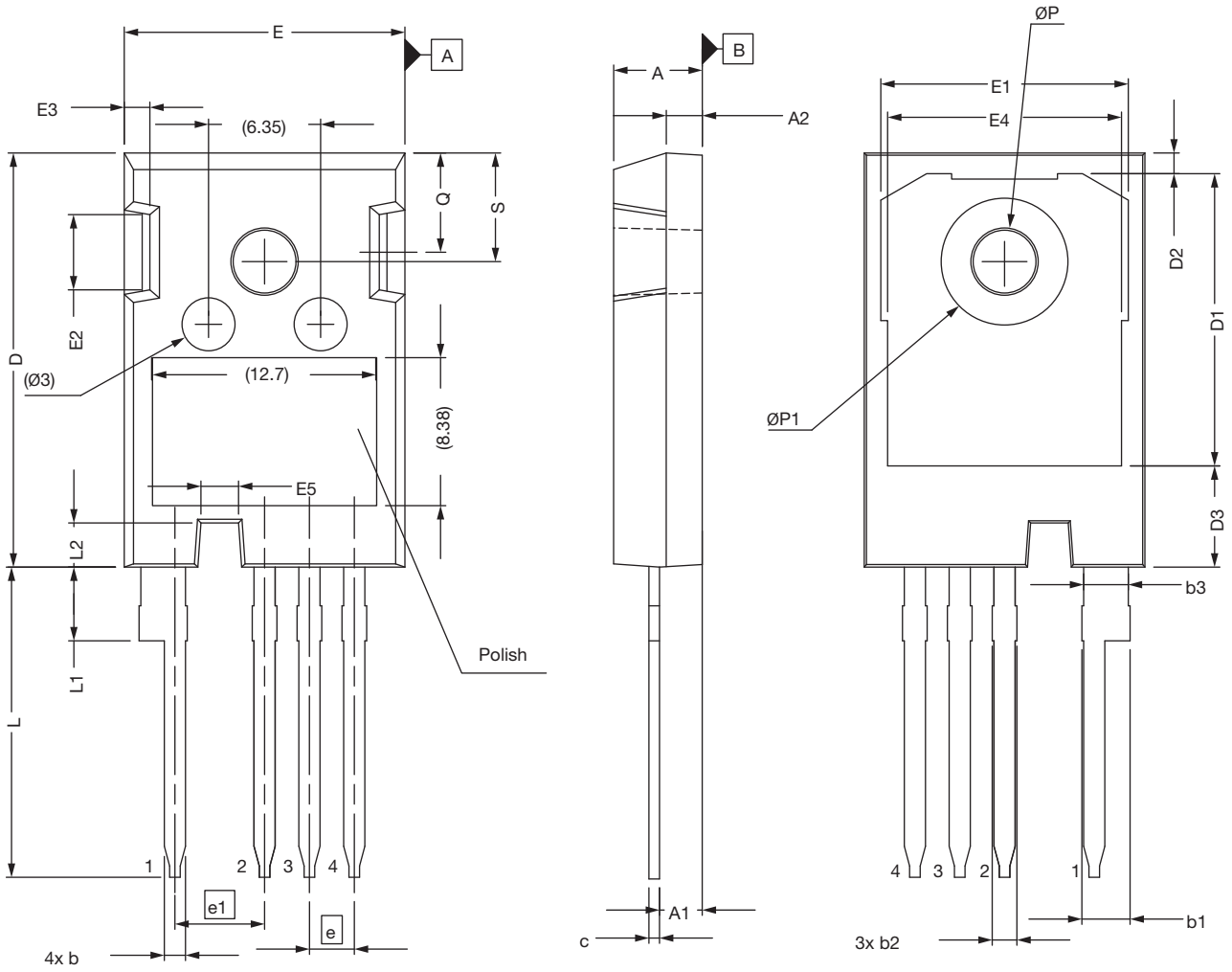
E
A
E3
(6.35)
Q
S
D
E2
(Ø3)
(12.7)
(8.38)
E5
L2
L1
L
Polish
1
2
3
4
e1
e
4x b
B
A
A2
A1
c
ØP
E1
E4
D2
D1
ØP1
D3
b3
4
3
2
1
b1
3x b2

| DIM. | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 4.83 | 5.02 | 5.21 |
| A1 | 2.29 | 2.41 | 2.54 |
| A2 | 1.91 | 2.00 | 2.16 |
| b | 1.07 | 1.20 | 1.33 |
| b1 | 2.39 | 2.67 | 2.94 |
| b2 | 1.07 | 1.30 | 1.60 |
| b3 | 2.39 | 2.53 | 2.69 |
| c | 0.55 | 0.60 | 0.68 |
| D | 23.30 | 23.45 | 23.60 |
| D1 | 16.25 | 16.55 | 17.65 |
| D2 | 0.95 | 1.19 | 1.25 |
| D3 | 5.55 | 5.71 | 6.01 |
| E | 15.75 | 15.94 | 16.13 |
| E1 | 13.10 | 14.02 | 14.15 |
| E2 | 3.68 | 4.40 | 5.10 |
| E3 | 1.00 | 1.45 | 1.90 |
| E4 | 12.38 | 13.26 | 13.43 |
| E5 | 1.95 | 2.15 | 2.35 |
| e | 2.54 BSC. | | |
| e1 | 5.08 BSC. | | |
| L | 17.31 | 17.57 | 17.82 |
| L1 | 3.97 | 4.19 | 4.37 |
| L2 | 2.35 | 2.50 | 2.65 |
| ØP | 3.51 | 3.61 | 3.65 |
| ØP1 | 7.19 ref. | | |
| Q | 5.49 | 5.79 | 6.00 |
| S | 6.04 | 6.17 | 6.30 |

**Notes**

- All dimensions are in mm
- Dimension D and E do not include mold flash.
- Creepage 1 is 8.40 mm (ref.) which is the distance alongside the surface between drain (pin 1) and trough the notch towards source (pin 2). Creepage 2 is 7.70 mm (ref.) which is the distance from end of the copper slug on the backside of the package to either pin 2, pin 3 or pin 4

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