# QS1200SCM36: 1200V N-Channel SiC MOSFET

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## Description

- FAST SWITCHING WITH LOW EMI/RFI
- LOW GATE CHARGE MINIMIZE SWITCHING LOSS
- SHORT CIRCUIT WITHSTAND RATED
- LOW RDS(ON) TEMPERATURE COEFFICIENT FOR IMPROVE EFFICIENCY

## Applications

- ASYMMETRICAL BRIDGE
- CONVERTER
- INVERTER
- SINGLE SWITCH FORWARD
- FLYBACK
- PV INVERTER (STRING SOLAR INVERTER)
- EV CHARGING PILE

## Part Number

**QS1200SCM36**

## Package

**TO-3P**

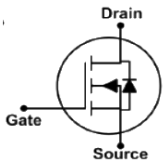
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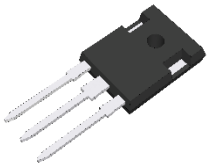
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## Features

| PARAMETER | VALUE | UNIT |
|---|---|---|
| $BV_{DSS}$ | 1200 | V |
| $R_{DS(ON),typ}$ $(20V)$ | 80 | mΩ |
| $V_{GS(TH),typ}$ | 2.8 | V |
| $E_{ON}$ | 325 | μJ |
| $E_{OFF}$ | 219 | μJ |
| $I_D$ $(at\ 25℃)$ | 36 | A |

## Package



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**ABSOLUTE MAXIMUM RATINGS** (Ta = 25°C Unless otherwise specified)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-to-Source Voltage | $V_{DSS}$ | 1200 | $V$ |
| Maximum Gate-to-Source Voltage | $V_{GSmax}$ | $-10 \sim +25$ | |
| Recommended operations values of gate to source voltage | $V_{GSop(DC)}$ | $-5.0 \sim +20$ | |
| Recommended operations values of gate to source voltage (f>1Hz) | $V_{GSop(AC)}$ | $-5.0 \sim +20$ | |
| Continuous Drain Current | $I_D$ | 36.0 | $A$ |
| Continuous Drain Current at $\boldsymbol{T_c = 100}$℃ | | 25.0 | |
| Pulsed Drain Current at $\boldsymbol{VGS = 10V^2}$ | $I_{DM}$ | 90 | |
| Single Pulse Avalanche Energy $(\boldsymbol{V_{DD} = 50V, V_{GS} = 15V, R_G = 25\Omega, L = 1mH})$ | $E_{AS}$ | 171 | $mJ$ |
| Power Dissipation | $P_D$ | 198 | $W$ |
| Derating Factor above 25°C | | 1.30 | ℃/$W$ |
| Soldering Temperature, Distance of 1.6mm from case for 10 seconds | $T_L$ | 300 | ℃ |
| Operating and Storage Temperature Range | $T_J, T_{STG}$ | $-55\ to\ 175$ | |
| Caution: Stresses greater than those listed in the Absolute Maximum Ratings may cause permanent damage to devices. | | | |
| Thermal Characteristics | | | |
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.76 | ℃/$W$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 40 | |

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## ELECTRICAL CHARACTERISTICS (Ta = 25°C Unless otherwise specified)

| Parameter | Symbol | Test Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| OFF Characteristics ($T_J$ = 25°C unless otherwise specified) | | | | | | |
| Drain-to-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS} = 0V, I_D = 100\mu A$ | 1200 | – | – | $V$ |
| Drain-to-Source Leakage Current | $I_{DSS}$ | $V_{DS} = 1200V, V_{GS} = 0V$ | – | – | 100 | $\mu A$ |
| Gate-to-Source Leakage Current | $I_{Gss+}$ | $V_{DS} = 0V, V_{GS} = 20V$ | – | – | 100 | $nA$ |
| Gate-to-Source Leakage Current | $I_{Gss-}$ | $V_{DS} = 0V, V_{GS} = -10V$ | – | – | −100 | $nA$ |
| ON Characteristics ($T_J$ = 25°C unless otherwise specified) | | | | | | |
| Static Drain-to-Source On Resistance [3] | $R_{DS(ON)}$ | $V_{GS} = 20V, I_D = 20A$ | – | 80 | 100.0 | $m\Omega$ |
| | | $V_{GS} = 20V, I_D = 20A, T_J = 150°C$ | – | 121 | – | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 5mA$ | 1.8 | 2.8 | 3.8 | $V$ |
| Dynamic Characteristics (Essentially independent of operating temperature) | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS} = 0V$<br>$V_{DS} = 800V$<br>$f = 1MHz$ | – | 1001 | – | $pF$ |
| Reverse Transfer Capacitance | $C_{rss}$ | | – | 7.2 | – | |
| Output Capacitance | $C_{oss}$ | | – | 60 | – | |
| Gate Series Resistance | $R_g$ | $f = 1MHz$ | – | 5.6 | – | $\Omega$ |
| Total Gate Charge | $Q_g$ | $V_{DD} = 600V$<br>$I_D = 20A$<br>$V_{GS} = -\frac{5}{20V}$ | – | 60 | – | $nC$ |
| Gate-to-Source Charge | $Q_{gs}$ | | – | 16 | – | |
| Gate-to-Drain (Miller) Charge | $Q_{gd}$ | | – | 23 | – | |
| Resistive Switching Characteristics (Essentially independent of operating temperature) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD} = 800V$<br>$I_D = 20A$<br>$V_{GS} = -\frac{5}{20V}$<br>$R_G = 4.7\Omega$<br>$L = 500\mu H$ | – | 11 | – | $nS$ |
| Rise Time | $t_{rise}$ | | – | 37 | – | |
| Turn-off Delay Time | $t_{d(off)}$ | | – | 24 | – | |
| Fall Time | $t_{fall}$ | | – | 9.8 | – | |
| Turn-On Switching Energy | $E_{ON}$ | | – | 325 | – | μJ |
| Turn-Off Switching Energy | $E_{OFF}$ | | – | 219 | – | |
| Source-Drain Body Diode Characteristics ($T_J$ = 25°C unless otherwise specified) | | | | | | |
| Continuous Source Current | $I_{SD}$ | $Maximum\ Ratings$ | – | – | 36 | $A$ |
| Diode Forward Voltage | $V_{SD}$ | $I_S = 0.5A, V_{GS} = 0V$ | – | 2.6 | – | $V$ |
| Reverse Recovery Time | $t_{rr}$ | $V_{GS} = 0V$<br>$I_F = 20A$<br>$\frac{di}{dt} = 800A/\mu s$ | – | 20 | – | $nS$ |
| Reverse Recovery Charge | $Q_{rr}$ | | – | 39 | – | $nC$ |
| Peak Reverse Recovery Charge | $I_{mm}$ | | – | 2.8 | – | $A$ |

- TJ=25°C to 175°C

- Repetitive rating, pulse width limited by maximum junction temperature

-Pulse width≤380μs; duty cycle≤2%

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**Figure 1: Maximum effective Thermal impedance, junction - to - Case**

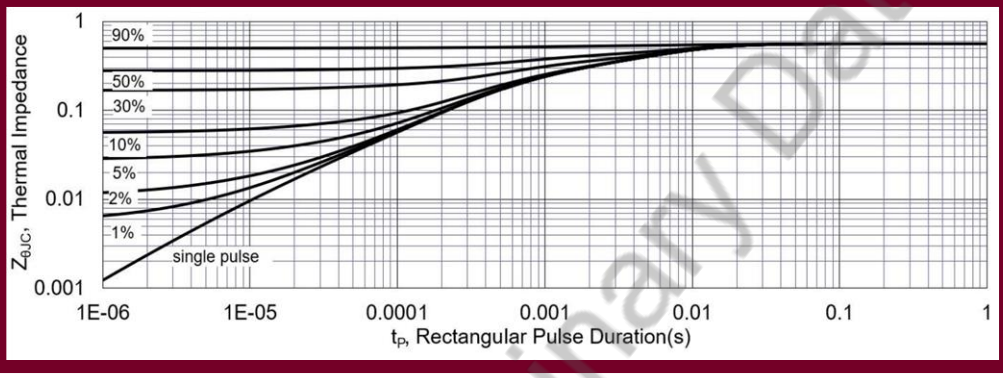



**Figure 2: Maximum Power Dissipation vs Case Temperature**

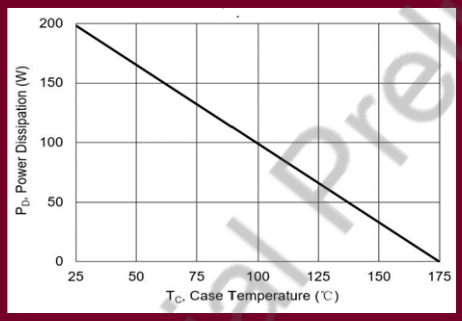



**Figure 3: Maximum Continuous Drain Current vs Case Temperature**

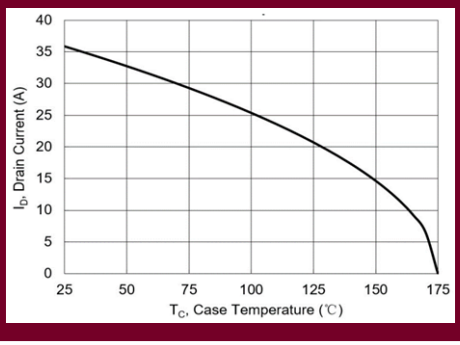



**Figure 4: Typical Output Characteristics**

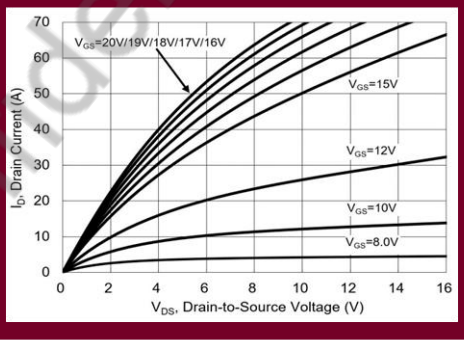
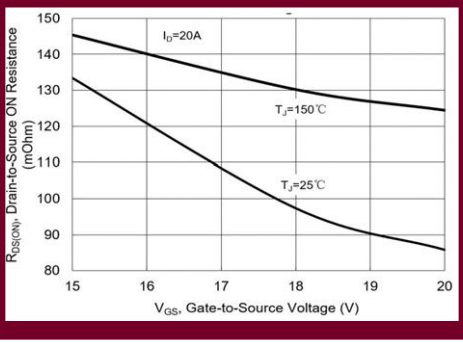



**Figure 5: Typical Drain-to-Source ON Resistance vs Gate Voltage**




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Figure 6: Maximum Peak Current Capability

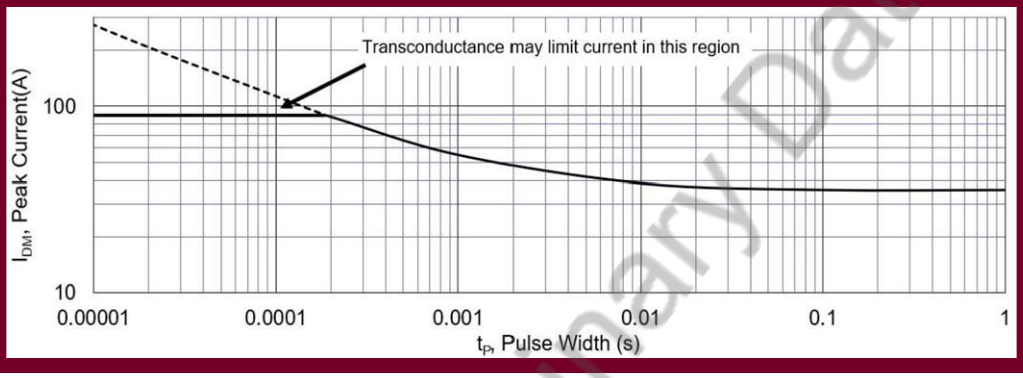



Figure 7: Typical Transfer Characteristics

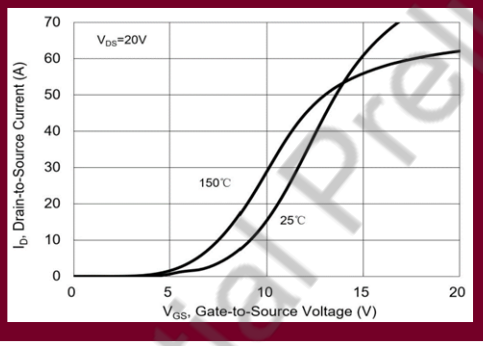



Figure 8: Typical Drain to Source ON Resistance

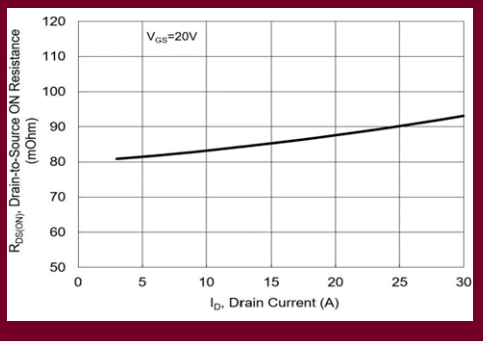



Figure 9: Typical Drain to Source ON Resistance vs Junction Temperature

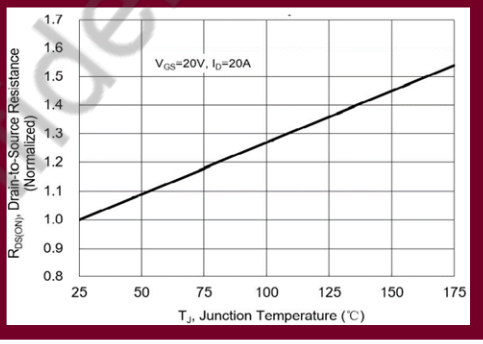
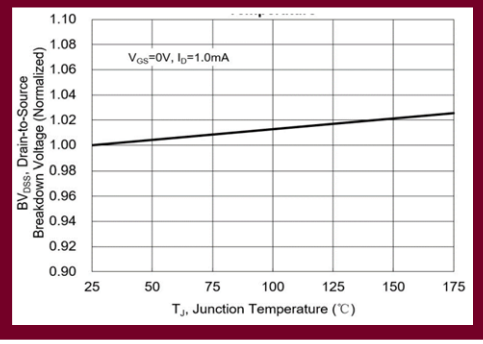



Figure 10: Typical Breakdown Voltage vs. Junction Temperature




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**Figure 11: Typical Threshold Voltage vs. Junction Temperature**

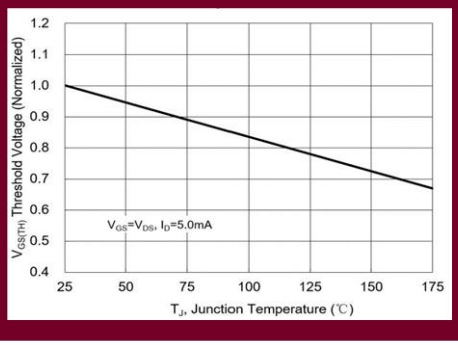



**Figure 12: Typical Capacitance vs. Drain-to-Source Voltage**

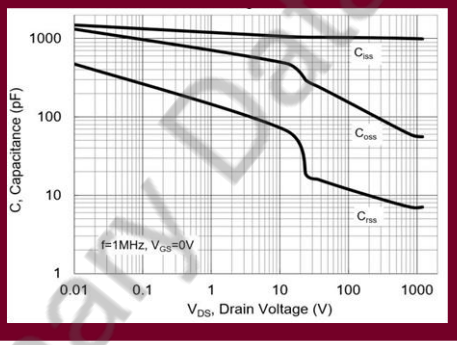



**Figure 13: Maximum Forward Safe Operating Area**

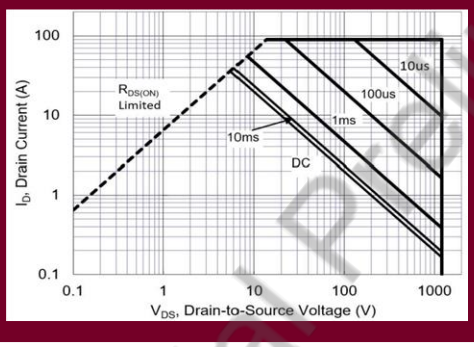
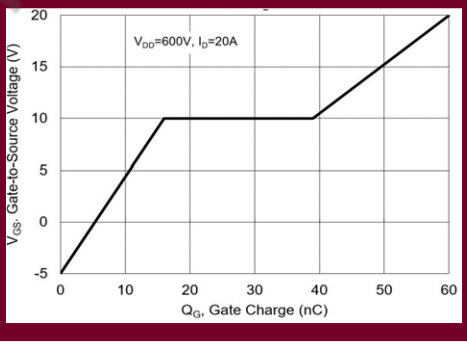



**Figure 14: Typical Gate Charge vs. Gate to Source Voltage**

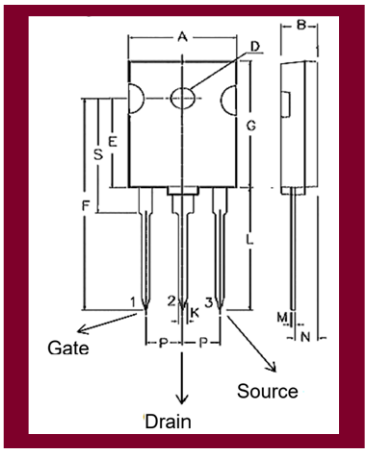



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| DIM | MIN | MAX |
|---|---|---|
| A | 15.20 | 15.80 |
| B | 4.90 | 5.10 |
| D | 3.90 | 4.10 |
| E | 14.20 | 14.80 |
| F | 28.20 | 30.50 |
| G | 19.50 | 19.80 |
| K | 1.00 | 1.30 |
| L | 14.10 | 17.50 |
| M | 0.40 | 0.60 |
| N | 2.50 | 2.75 |
| P | 5.21 | 5.72 |
| S | 18.25 | 19.25 |

Pin configuration:

1. Gate
2. Drain
3. Source

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