RECTRON SEMICONDUCTOR
TECHNICAL SPECIFICATION

# RSM120N120T7L

## N-Channel SiC Power MOSFET

| | | | |
|---|---|---|---|
| $V_{DS}$ | = | 1200 | V |
| $R_{DS(on)}$ | = | 16 | mΩ |
| $I_D$@25℃ | = | 120 | A |

### Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitance
- Easy to Parallel and Simple to Drive

### Benefits

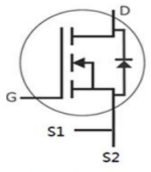
- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

### Applications

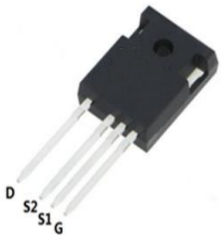
- Solar and UPS inverters
- EV motor drive
- High voltage DC/DC converters
- Switched mode power supplies
- Load switch
- Halogen-free

### Package

RoHS




S1: Driver Source
S2: Power Source




| Part Number | Package | Marking |
|---|---|---|
| RSM120N120T7L | TO-247-4 | 120N120 |

### Maximum Ratings ($T_C$=25℃ unless otherwise specified)

| Symbol | Parameter | Value | Unit | Test Conditions | Note |
|---|---|---|---|---|---|
| $V_{DSmax}$ | Drain-Source Voltage | 1200 | V | $V_{GS}$=0V, $I_D$=100μA | |
| $V_{GSmax}$ | Gate-Source Voltage | -8/+22 | V | Absolute maximum values | |
| $V_{GSop}$ | Gate-Source Voltage | -4/+18 | V | Recommended operational values | |
| $I_D$ | Continuous Drain Current | 120 | A | $V_{GS}$=18V, $T_c$=25℃ | Fig. 19 |
| | | 85 | | $V_{GS}$=18V, $T_c$=100℃ | |
| $I_{D(pulse)}$ | Pulsed Drain Current | 250 | A | Pulse width $t_p$ limited by $T_{Jmax}$ | Fig. 22 |
| $P_D$ | Power Dissipation | 375 | W | $T_c$=25℃, $T_J$=175℃ | Fig. 20 |
| $T_J$, $T_{STG}$ | Operating Junction and Storage Temperature | -55 to +175 | ℃ | | |
| $T_L$ | Solder Temperature, 1.6mm from case for 10s | 260 | ℃ | | |
| $M_d$ | Mounting Torque, (M3 or 6-32 screw) | 1<br>8.8 | Nm<br>lbf-in | | |

## Electrical Characteristics ($T_C$=25℃ unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions | Note |
|---|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | 1200 | / | / | V | $V_{GS}$=0V, $I_D$=100μA | |
| $V_{GS(th)}$ | Gate Threshold Voltage | 1.9 | 2.6 | 4.0 | V | $V_{DS}$=$V_{GS}$, $I_D$=23mA | Fig. 11 |
| | | / | 1.8 | / | | $V_{DS}$=$V_{GS}$, $I_D$=23mA, $T_J$=175℃ | |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | / | 1 | 100 | μA | $V_{DS}$=1200V, $V_{GS}$=0V | |
| $I_{GSS+}$ | Gate-Source Leakage Current | / | 10 | 250 | nA | $V_{DS}$=0V, $V_{GS}$=22V | |
| $I_{GSS-}$ | Gate-Source Leakage Current | / | 10 | 250 | nA | $V_{DS}$=0V, $V_{GS}$=-8V | |
| $R_{DS(on)}$ | Drain-Source On-State Resistance | / | 16 | 22.3 | mΩ | $V_{GS}$=18V, $I_D$=75A | Fig. 4,5,6 |
| | | / | 28 | / | | $V_{GS}$=18V, $I_D$=75A, $T_J$=175℃ | |
| $g_{fs}$ | Transconductance | / | 41.4 | / | S | $V_{DS}$=20V, $I_{DS}$=75A | Fig. 7 |
| | | / | 36.5 | / | | $V_{DS}$=20V, $I_{DS}$=75A, $T_J$=175℃ | |
| $C_{iss}$ | Input Capacitance | / | 4817 | / | pF | $V_{GS}$=0V<br>$V_{DS}$=1000V<br>f=1MHz<br>$V_{AC}$=25mV | Fig. 17,18 |
| $C_{oss}$ | Output Capacitance | / | 207 | / | | | |
| $C_{rss}$ | Reverse Transfer Capacitance | / | 45 | / | | | |
| $E_{oss}$ | $C_{oss}$ Stored Energy | / | 104 | / | μJ | | Fig. 16 |
| $E_{ON}$ | Turn-On Switching Energy | / | 2.1 | / | mJ | $V_{DS}$=800V, $V_{GS}$=-4V/18V<br>$I_D$=30A, $R_{G(ext)}$=2.5Ω, L=100μH | |
| $E_{OFF}$ | Turn-Off Switching Energy | / | 1.6 | / | | | |
| $t_{d(on)}$ | Turn-On Delay Time | / | 150 | / | ns | $V_{DS}$=800V, $V_{GS}$=-4V/18V, $I_D$=30A<br>$R_{G(ext)}$=2.5Ω, $R_L$=20Ω | |
| $t_r$ | Rise Time | / | 38 | / | | | |
| $t_{d(off)}$ | Turn-Off Delay Time | / | 108 | / | | | |
| $t_f$ | Fall Time | / | 35 | / | | | |
| $R_{G(int)}$ | Internal Gate Resistance | / | 4.5 | / | Ω | f=1MHz, $V_{AC}$=25mV | |
| $Q_{GS}$ | Gate to Source Charge | / | 66 | / | nC | $V_{DS}$=800V<br>$V_{GS}$=-4V/18V<br>$I_D$=30A | Fig. 12 |
| $Q_{GD}$ | Gate to Drain Charge | / | 48 | / | | | |
| $Q_G$ | Total Gate Charge | / | 269 | / | | | |

## Reverse Diode Characteristics

| Symbol | Parameter | Typ. | Max. | Unit | Test Conditions | Note |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | 4.2 | / | V | $V_{GS}$=-4V, $I_{SD}$=37.5A, $T_J$=25℃ | Fig. 8,9,10 |
| | | 3.9 | / | | $V_{GS}$=-4V, $I_{SD}$=37.5A, $T_J$=175℃ | |
| $I_S$ | Continuous Diode Forward Current | / | 120 | A | $T_C$=25℃ | |
| $t_{rr}$ | Reverse Recover Time | 54 | / | ns | $V_R$=800V, $I_{SD}$=30A | |
| $Q_{rr}$ | Reverse Recovery Charge | 630 | / | nC | | |
| $I_{rrm}$ | Peak Reverse Recovery Current | 19 | / | A | | |

## Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit | Test Conditions | Note |
|---|---|---|---|---|---|---|
| $R_{θJC}$ | Thermal Resistance from Junction to Case | 0.23 | / | ℃/W | | Fig. 21 |
| $R_{θJA}$ | Thermal Resistance from Junction to Ambient | / | 40 | | | |

## RATING AND CHARACTERISTICS CURVES (RSM120N120T7L)

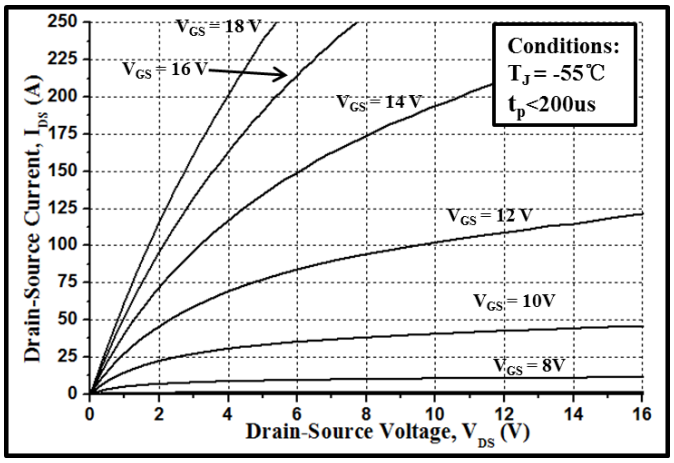



Figure 1. Output Characteristics $T_J$ = -55℃

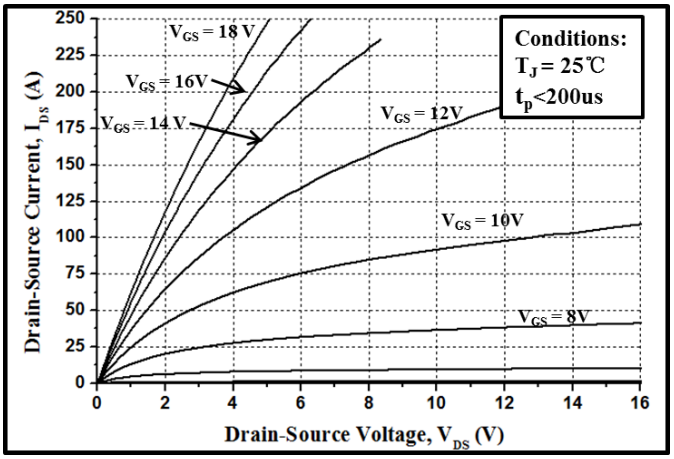



Figure 2. Output Characteristics $T_J$ = 25℃

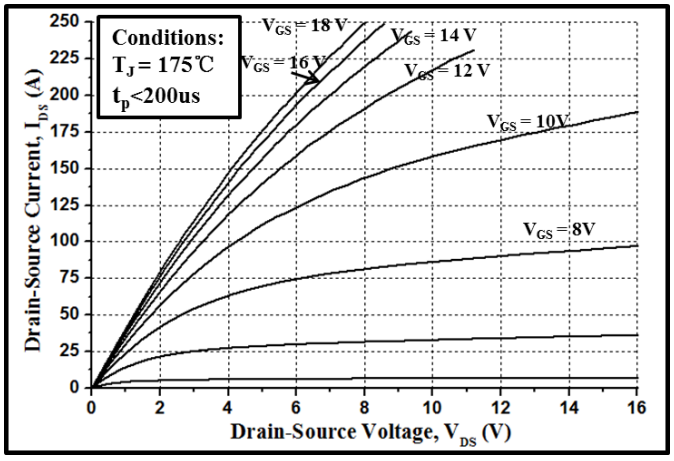



Figure 3. Output Characteristics $T_J$ = 175℃

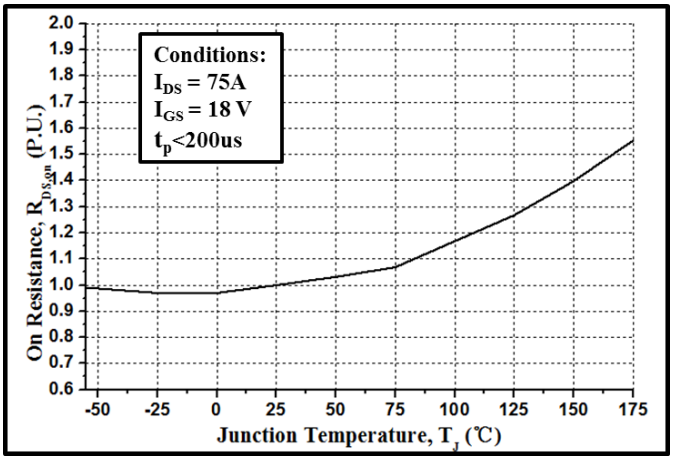



Figure 4. Normalized On-Resistance vs. Temperature

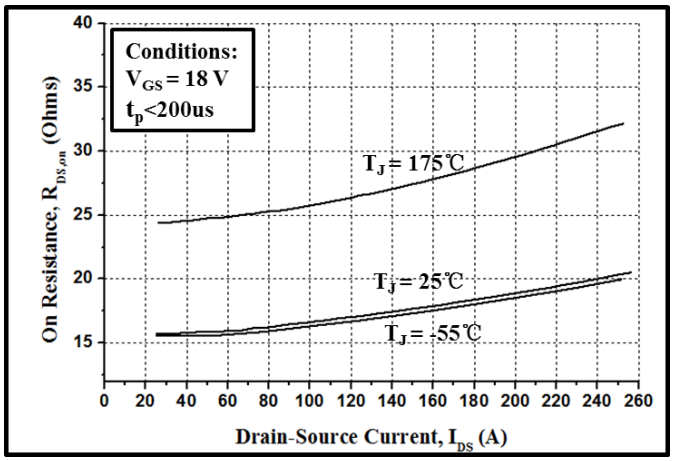



Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

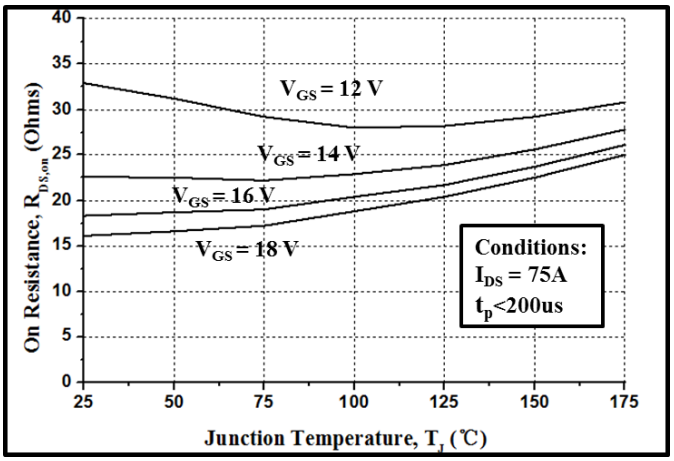



Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

## RATING AND CHARACTERISTICS CURVES (RSM120N120T7L)

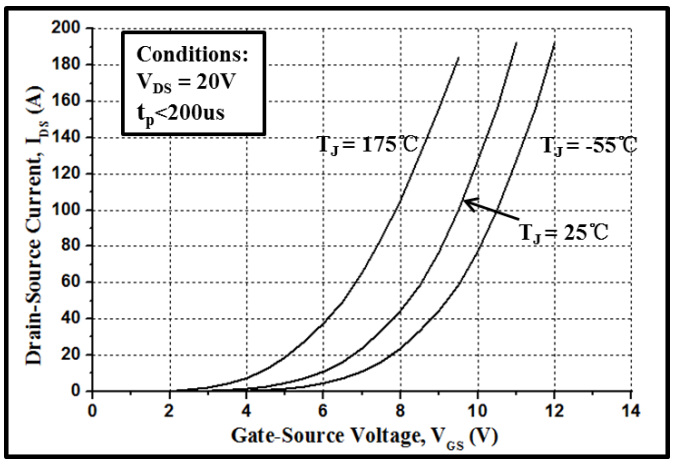



Figure 7. Transfer Characteristic for Various Junction Temperatures

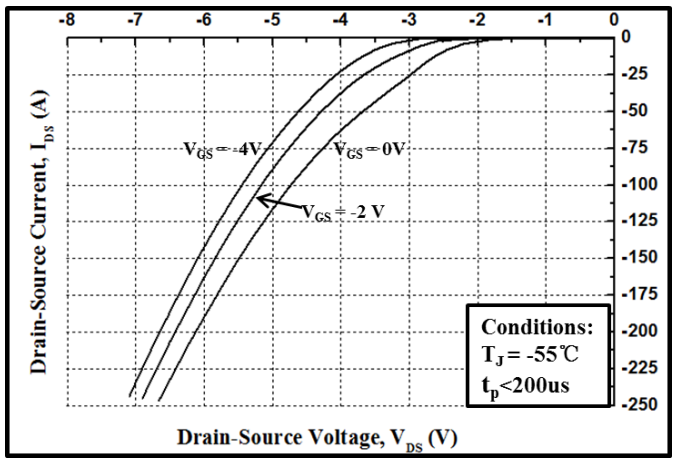



Figure 8. Body Diode Characteristic at -55℃

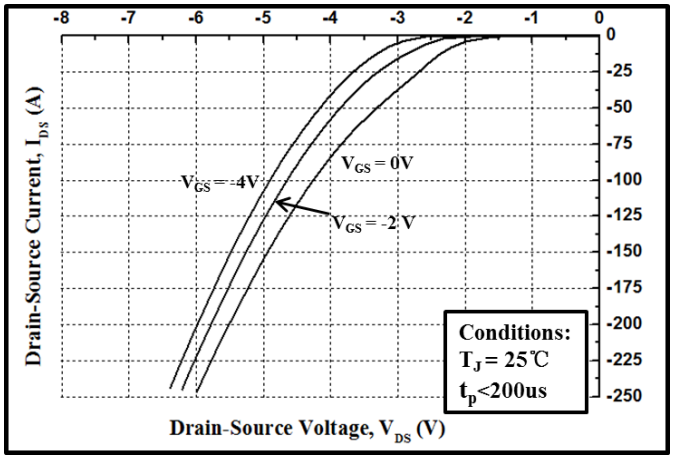



Figure 9. Body Diode Characteristic at 25℃

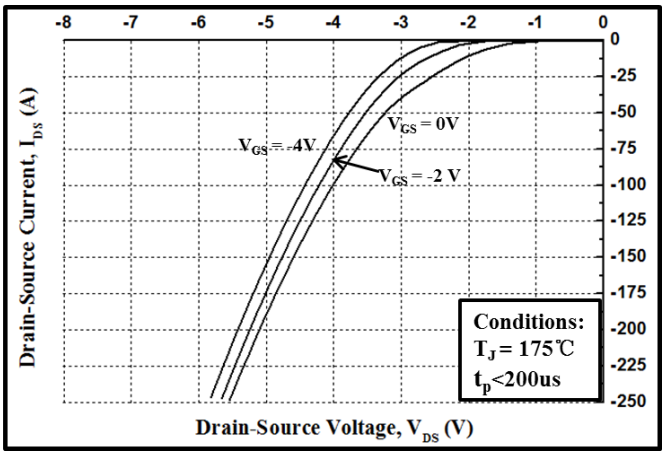



Figure 10. Body Diode Characteristic at 175℃

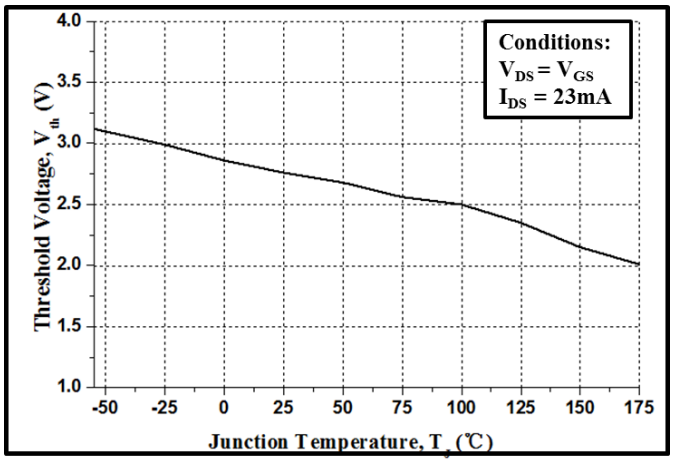



Figure 11. Threshold Voltage vs. Temperature

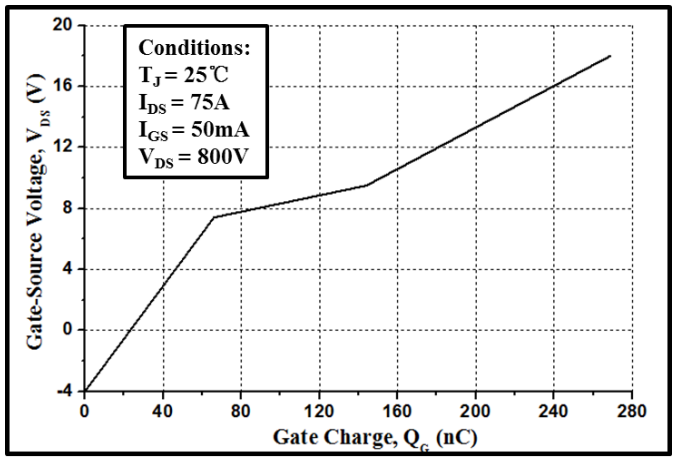



Figure 12. Gate Charge Characteristics

## RATING AND CHARACTERISTICS CURVES (RSM120N120T7L)

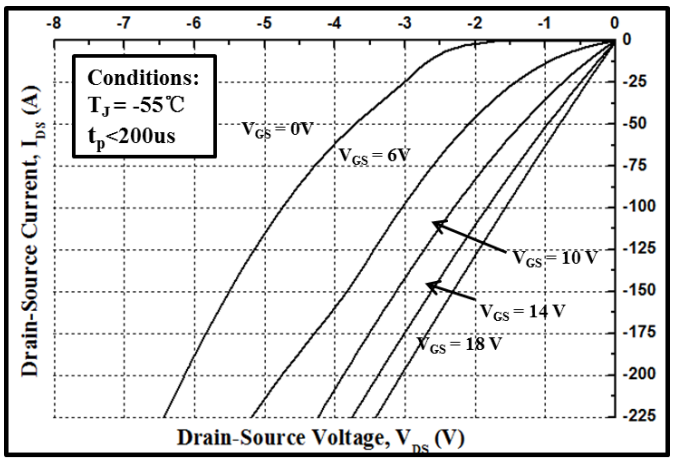



Figure 13. 3rd Quadrant Characteristic at -55℃

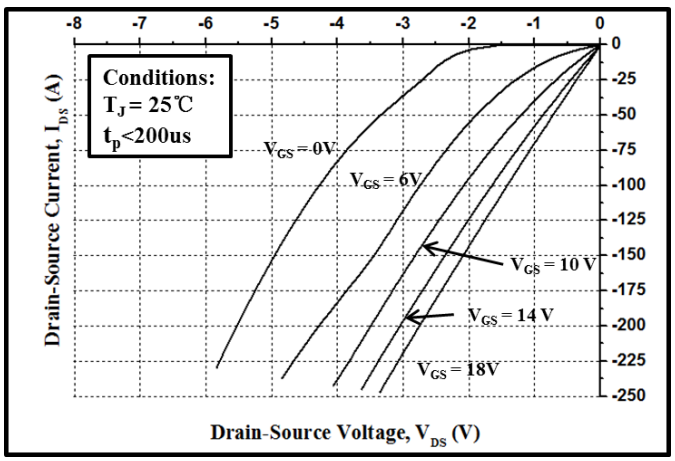



Figure 14. 3rd Quadrant Characteristic at 25℃

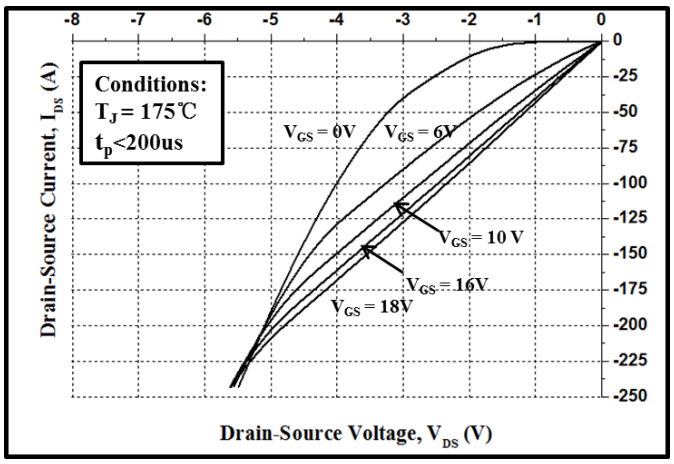



Figure 15. 3rd Quadrant Characteristic at 175℃

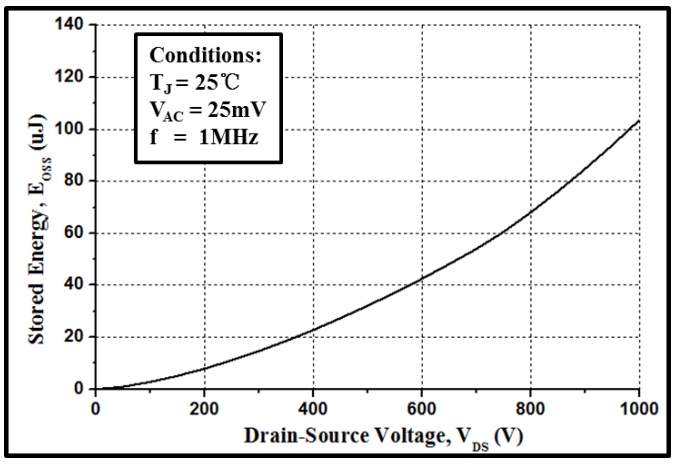



Figure 16. Output Capacitor Stored Energy

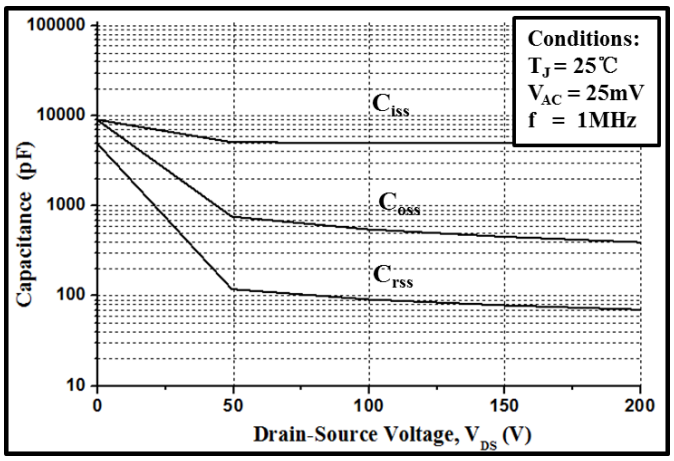



Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

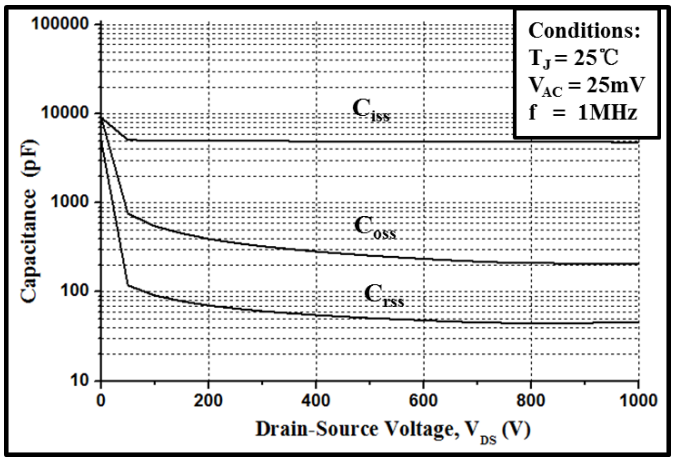



Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)

## RATING AND CHARACTERISTICS CURVES (RSM120N120T7L)

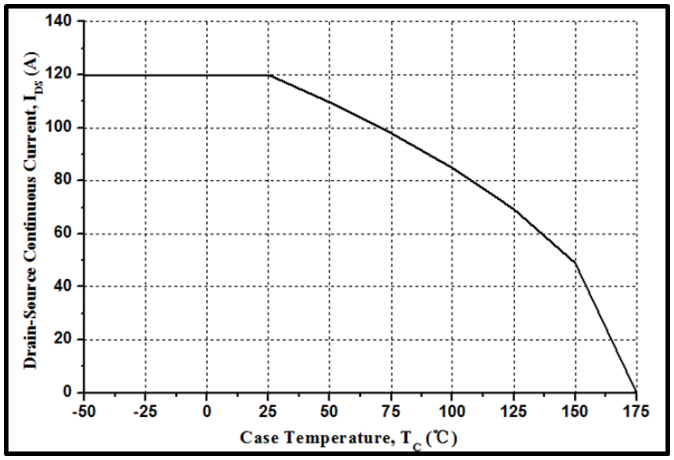



Figure 19. Continuous Drain Current vs. Case Temperature

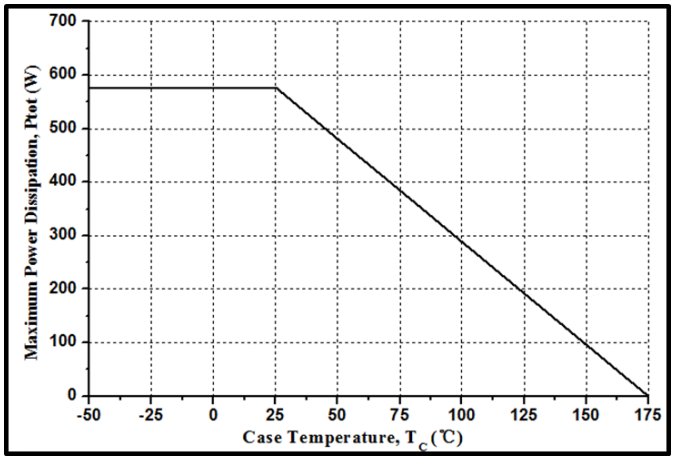



Figure 20. Maximum Power Dissipation vs. Case Temperature

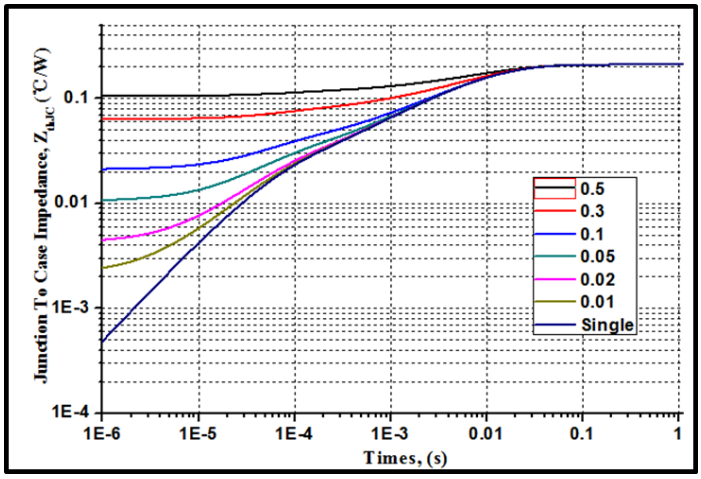



Figure 21. Transient Thermal Impedance (Junction - Case)

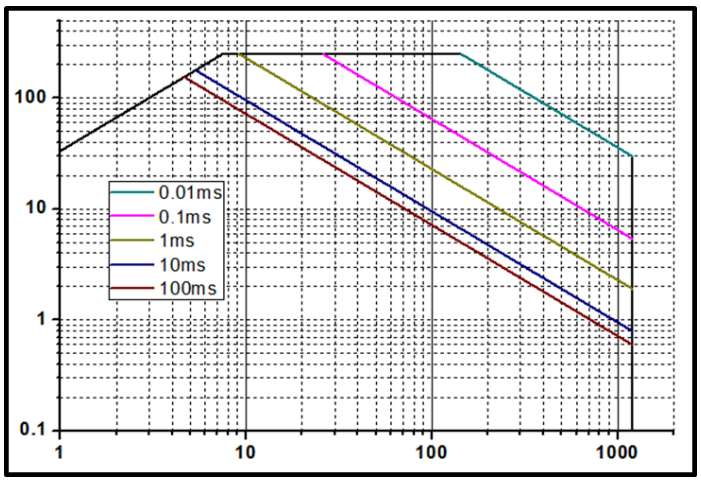



Figure22. Safe Operating Area

## Test Circuit Schematic

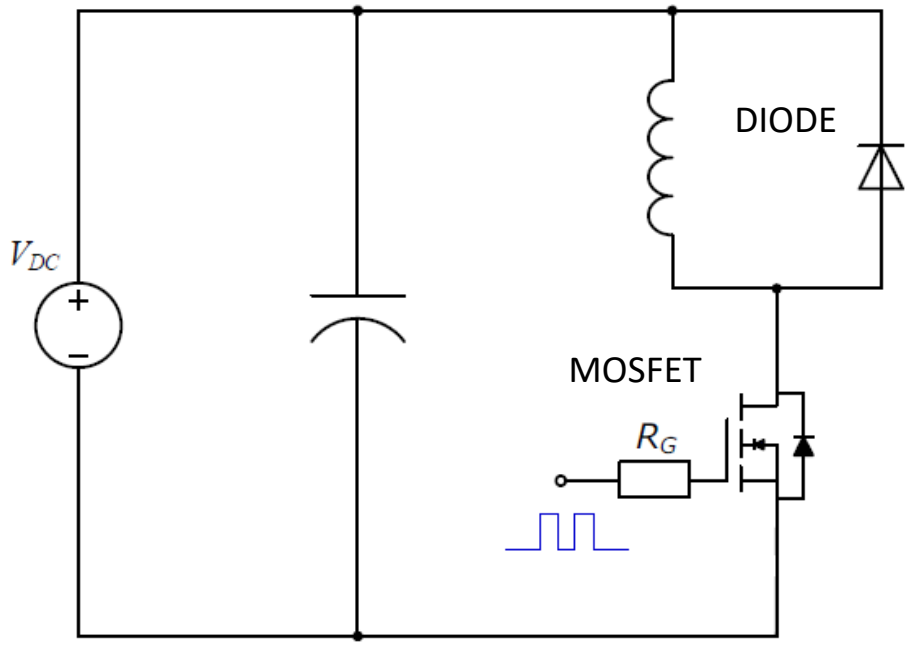
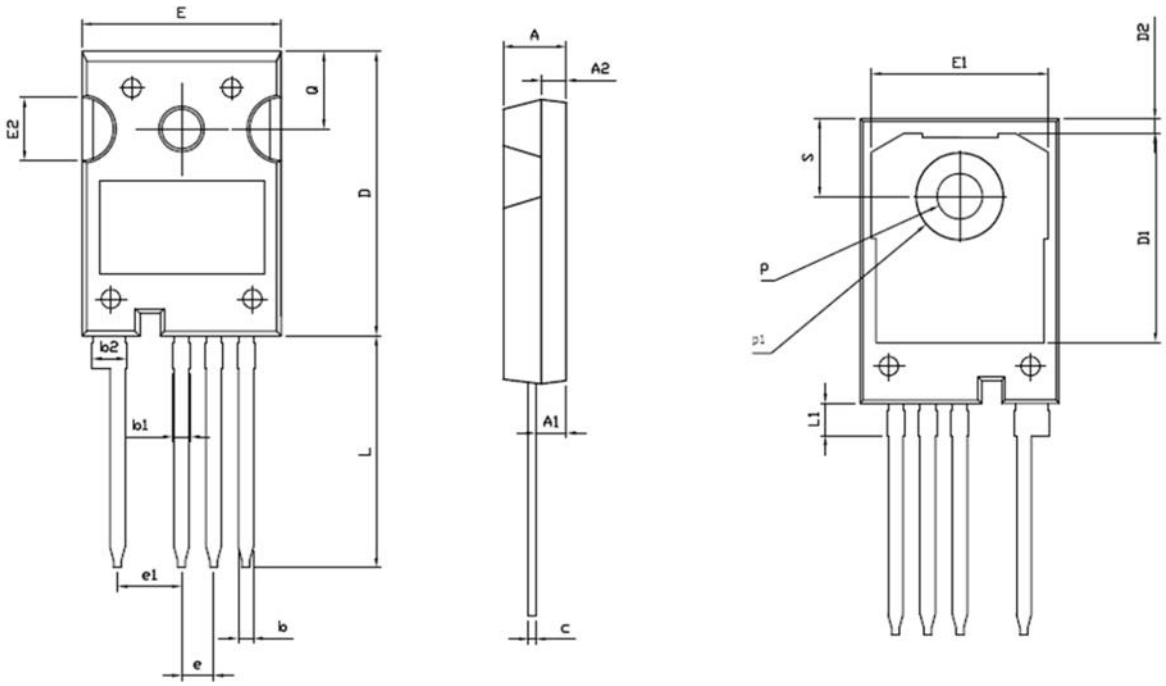
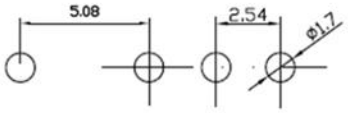



**Figure 23. Clamped Inductive Switching Waveform Test Circuit**

## Package Dimensions




RECOMMENDED LAND PATTERN




UNIT: mm

| | MIN | NOM | MAX |
|---|---|---|---|
| A2 | 1.85 | 2.00 | 2.15 |
| b | 1.05 | 1.20 | 1.35 |
| b1 | 1.00 | 1.30 | 1.60 |
| b2 | 2.35 | 2.65 | 2.95 |
| c | 0.50 | 0.60 | 0.70 |
| D | 22.34 | 22.54 | 22.74 |
| D1 | 16.00 | 16.50 | 17.00 |
| D2 | 0.97 | 1.17 | 1.37 |
| e | 2.34 | 2.54 | 2.74 |
| e1 | 4.88 | 5.08 | 5.28 |
| E | 15.60 | 15.80 | 16.00 |
| E1 | 13.50 | 14.00 | 14.50 |
| E2 | 4.80 | 5.00 | 5.20 |
| L | 18.08 | 18.38 | 18.68 |
| L1 | 2.38 | 2.58 | 2.78 |
| p | 3.50 | 3.60 | 3.70 |
| p1 | 6.60 | 6.80 | 7.00 |
| Q | 6.00 | 6.15 | 6.30 |
| S | 6.00 | 6.15 | 6.30 |

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