

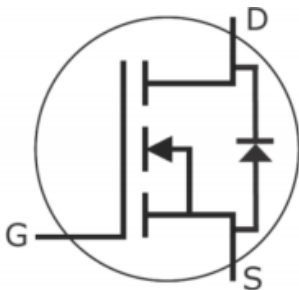
N-channel 1200V, 80mΩ typ,  
Coolin SiC MOS M1

## 1. Descriptions

### TO-247



### N-Channel MOSFET



## Key Performance Parameters

| Parameters                          | Value | Unit |
|-------------------------------------|-------|------|
| $BV_{DSS}$                          | 1200  | V    |
| $R_{DS(on), Typ.}$                  | 80    | mΩ   |
| $I_{DS@25\text{ }^{\circ}\text{C}}$ | 36    | A    |

## Features

- High Blocking Voltage with Low  $R_{DS(on)}$
- Fast Switching Speed with Low Capacitance
- Robust Design with Better Avalanche Performance
- Simple to Drive

## Applications

- Renewable Energy
- EV Battery Chargers
- High Voltage DC/DC Converters
- Switch Mode Power Supplies

| Type/Ordering Code | Package  | Marking      | Related Links  |
|--------------------|----------|--------------|----------------|
| CMW120R080M1       | TO-247-3 | CMW120R080M1 | See Appendix A |

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## 2. Maximum Ratings

At  $T_J = 25^\circ\text{C}$ , unless otherwise specified

**Table 1. Absolute Maximum Ratings**

| Parameter                                            | Symbol         | Values                                     | Unit             |
|------------------------------------------------------|----------------|--------------------------------------------|------------------|
| Drain-Source Voltage                                 | $V_{DSS}$      | 1200                                       | V                |
| Continuous Drain Current <sup>2)</sup>               | $I_D$          | $T_C=25^\circ\text{C}, V_{GS}=20\text{V}$  | A                |
|                                                      |                | $T_C=100^\circ\text{C}, V_{GS}=20\text{V}$ |                  |
| Pulsed Drain Current                                 | $I_{D,pulse}$  | 80                                         | A                |
| Gate Source Voltage (Recommended Operational Values) | $V_{GS}$       | -5 to 20                                   | V                |
| Operating and Storage Temperature                    | $T_J, T_{stg}$ | -55 to 150                                 | $^\circ\text{C}$ |
| Power Dissipation                                    | $P_D$          | 192                                        | W                |

## 3. Thermal Characteristics

**Table 2. Thermal Characteristics TO-247**

| Symbol     | Parameter                                                     | Values |      |      | Unit               | Test Condition                          |
|------------|---------------------------------------------------------------|--------|------|------|--------------------|-----------------------------------------|
|            |                                                               | Min.   | Typ. | Max. |                    |                                         |
| $R_{thJC}$ | Thermal Resistance, Junction - Case                           | -      | 0.6  | -    | $^\circ\text{C/W}$ | $T_C=25^\circ\text{C}$                  |
| $T_{sld}$  | Soldering Temperature,<br>Wavesoldering Only Allowed at Leads | -      | -    | 260  | $^\circ\text{C}$   | Lead Temperature<br>(Soldering, 10 sec) |

## 4. Electrical Characteristics

At  $T_J = 25^\circ\text{C}$ , unless otherwise specified

**Table 3. Static Characteristics**

| Symbol        | Parameter                        | Values |      |      | Unit          | Test Condition                                                |
|---------------|----------------------------------|--------|------|------|---------------|---------------------------------------------------------------|
|               |                                  | Min.   | Typ. | Max. |               |                                                               |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage   | 1200   | -    | -    | V             | $V_{GS}=0\text{V}, I_D=100\mu\text{A}$                        |
| $V_{(GS)th}$  | Gate Threshold Voltage           | 2.0    | 2.4  | 4.0  | V             | $V_{DS}=V_{GS}, I_D=5\text{mA}$                               |
|               |                                  |        | 1.8  |      |               | $V_{DS}=V_{GS}, I_D=5\text{mA}, T_J=150^\circ\text{C}$        |
| $I_{DSS}$     | Zero Gate Voltage Drain Current  | -      | 1    | 100  | $\mu\text{A}$ | $V_{DS}=1200\text{V}, V_{GS}=0\text{V}, T_J=25^\circ\text{C}$ |
| $I_{GSS}$     | Gate-Source Leakage Current      | -      | 10   | 250  | nA            | $V_{GS}=25\text{V}, V_{DS}=0\text{V}$                         |
| $R_{DS(on)}$  | Drain-Source On-State Resistance | -      | 80   | 98   | m $\Omega$    | $V_{GS}=20\text{V}, I_D=20\text{A}, T_J=25^\circ\text{C}$     |
|               |                                  |        | 140  | -    |               | $V_{GS}=20\text{V}, I_D=20\text{A}, T_J=150^\circ\text{C}$    |

**Table 4. Dynamic Characteristics**

| Symbol       | Parameter                    | Values |      |      | Unit     | Test Condition                                                                       |
|--------------|------------------------------|--------|------|------|----------|--------------------------------------------------------------------------------------|
|              |                              | Min.   | Typ. | Max. |          |                                                                                      |
| $C_{iss}$    | Input Capacitance            | -      | 1475 | -    | pF       | $V_{GS}=0V, V_{DS}=1000V, f=1MHz$                                                    |
| $C_{oss}$    | Output Capacitance           | -      | 94   | -    | pF       | $V_{GS}=0V, V_{DS}=1000V, f=1MHz$                                                    |
| $C_{rss}$    | Reverse Transfer Capacitance | -      | 11   | -    | pF       | $V_{GS}=0V, V_{DS}=1000V, f=1MHz$                                                    |
| $t_{d(on)}$  | Turn-On Delay Time           | -      | 9.3  | -    | ns       | $V_{DS}=1200V, V_{GS}= -5V \text{ to } 20V, I_D=30A, R_g=2.5 \Omega, R_L=600 \Omega$ |
| $t_r$        | Rise Time                    | -      | 9.5  | -    | ns       |                                                                                      |
| $t_{d(off)}$ | Turn-Off Delay Time          | -      | 18   | -    | ns       |                                                                                      |
| $t_f$        | Fall Time                    | -      | 7.6  | -    | ns       |                                                                                      |
| $E_{on}$     | Turn-On Switching Energy     | -      | 564  | -    | $\mu J$  | $V_{DS}=1200V, V_{GS}=-5V \text{ to } 20V, I_D=2A, R_g=2.5 \Omega, L=1500\mu H$      |
| $E_{off}$    | Turn-Off Switching Energy    | -      | 260  | -    |          |                                                                                      |
| $R_g$        | Internal Gate Resistance     | -      | 3.1  | -    | $\Omega$ | $f=1MHz$ Open Drain                                                                  |

**Table 5. Gate Charge Characteristics**

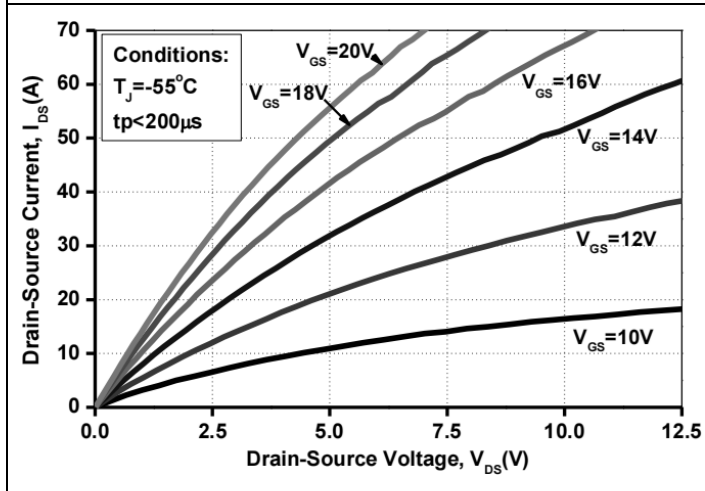
| Symbol   | Parameter             | Values |      |      | Unit | Test Condition                                     |
|----------|-----------------------|--------|------|------|------|----------------------------------------------------|
|          |                       | Min.   | Typ. | Max. |      |                                                    |
| $Q_{gs}$ | Gate to Source Charge | -      | 24   | -    | nC   | $V_{DS}=800V, V_{GS}=-5V \text{ to } 20V, I_D=20A$ |
| $Q_{gd}$ | Gate to Drain Charge  | -      | 15   | -    | nC   |                                                    |
| $Q_g$    | Gate Charge Total     | -      | 79   | -    | nC   |                                                    |

**Table 6. Reverse Diode Characteristics**

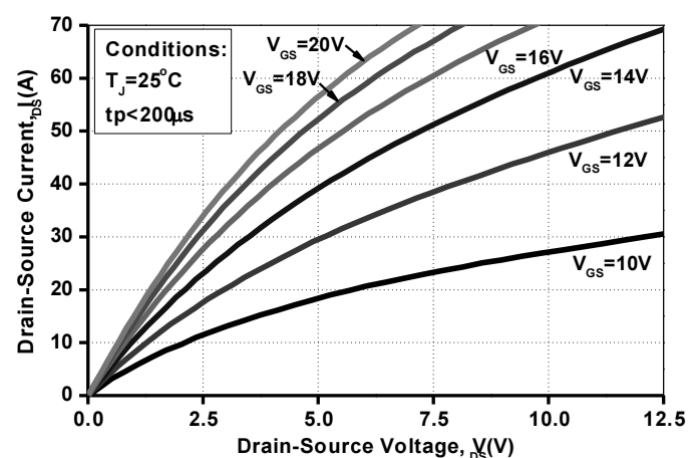
| Symbol    | Parameter                     | Values |      |      | Unit | Test Condition                            |
|-----------|-------------------------------|--------|------|------|------|-------------------------------------------|
|           |                               | Min.   | Typ. | Max. |      |                                           |
| $V_{SD}$  | Diode Forward Voltage         | -      | 3.6  | -    | V    | $V_{GS}=-5V, I_{SD}=10A, T_J=25^\circ C$  |
|           |                               |        | 3.3  |      |      | $V_{GS}=-5V, I_{SD}=10A, T_J=150^\circ C$ |
| $t_{rr}$  | Reverse Recovery Time         | -      | 35   | -    | ns   | $V_R=1200V, I_{SD}=20A$                   |
| $Q_{rr}$  | Reverse Recovery Charge       | -      | 91   | -    | nC   |                                           |
| $I_{rrm}$ | Peak Reverse Recovery Current | -      | 4.5  | -    | A    |                                           |

## 5. Electrical Characteristics Diagrams

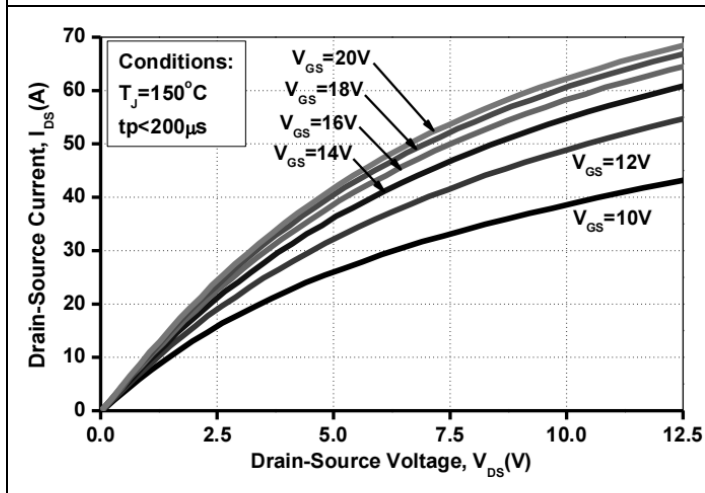
**Diagram 1: Typical Output Characteristics at -55°C**



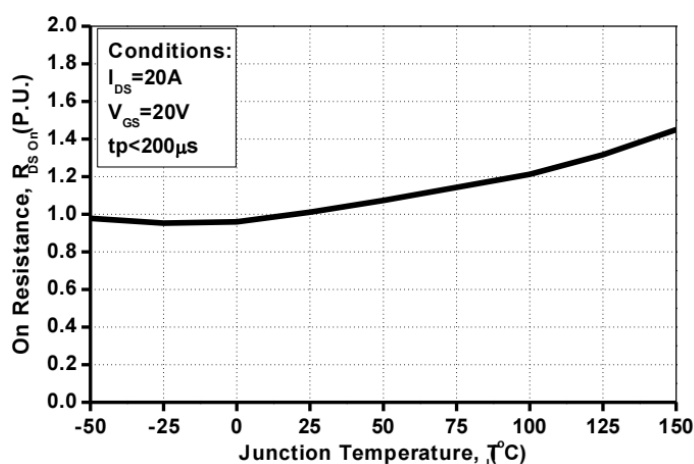
**Diagram 2: Typical Output Characteristics at 25°C**



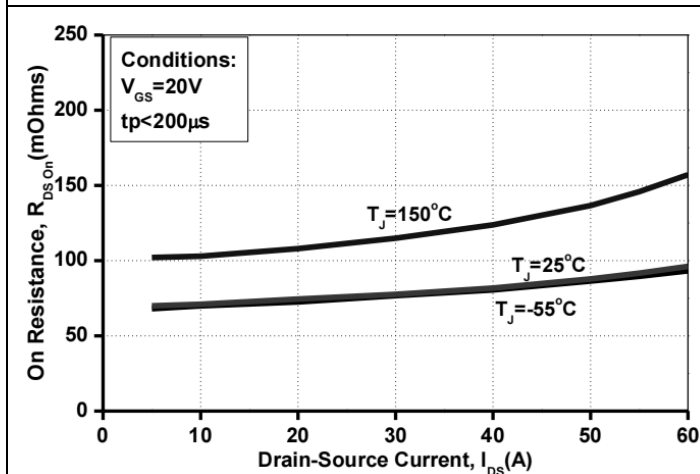
**Diagram 3: Typical Output Characteristics at 150°C**



**Diagram 4: Normalized On-Resistance vs. Temperature**



**Diagram 5: On-Resistance vs. Drain Current**



**Diagram 6: On-Resistance vs. Temperature**

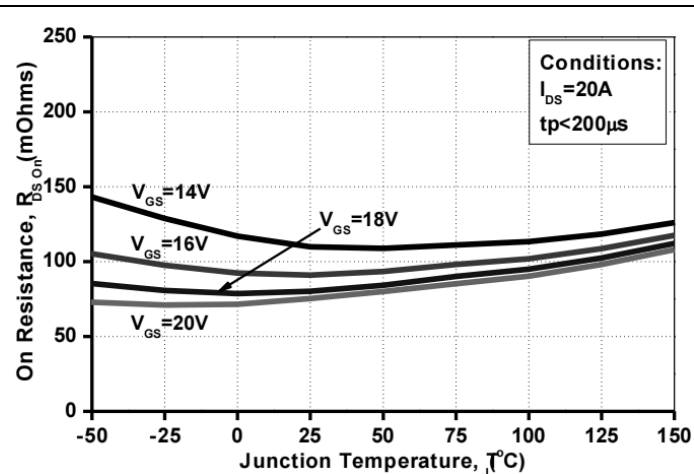


Diagram 7: Typical Transfer Characteristics

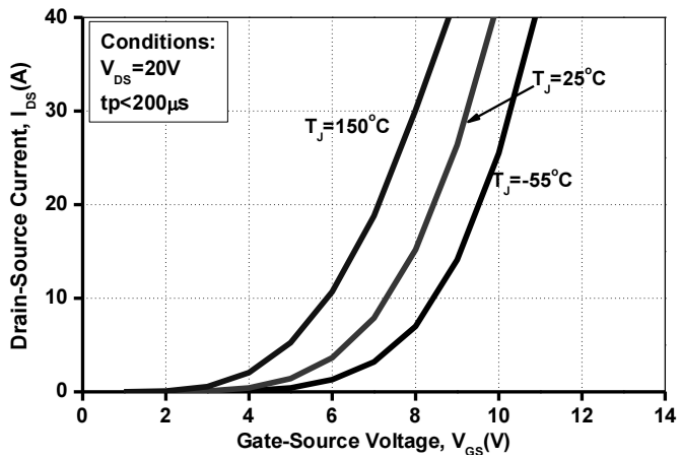


Diagram 8: Body Diode Characteristics at -55°C

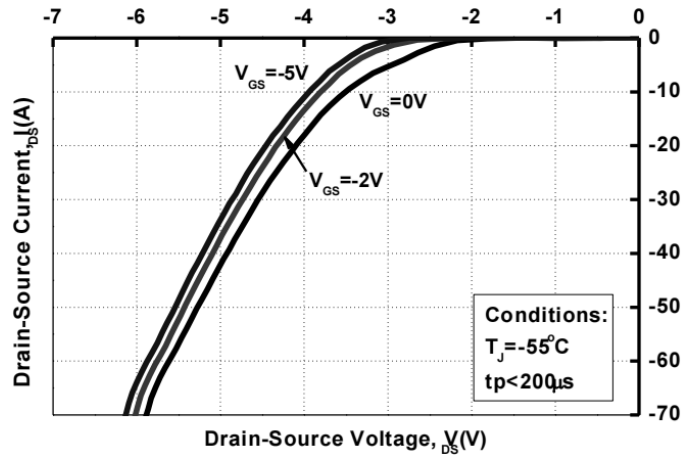


Diagram 9: Body Diode Characteristics at 25°C

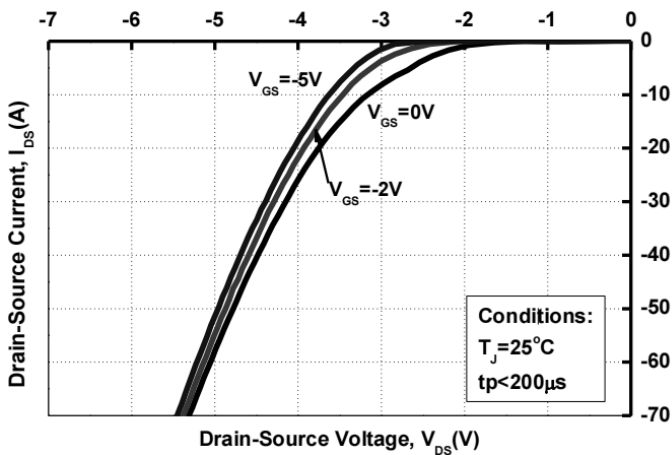


Diagram 10: Body Diode Characteristics at 150°C

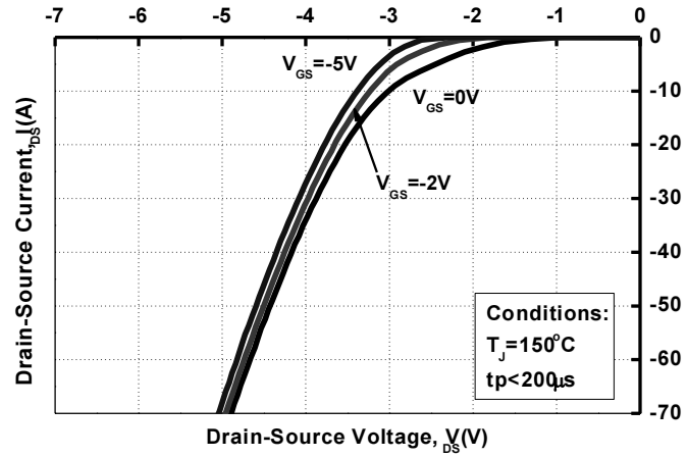


Diagram 11: Gate Threshold Voltage vs. Temperature

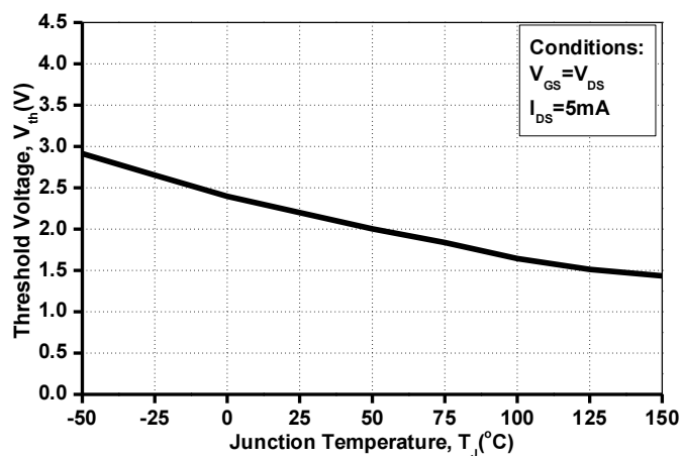
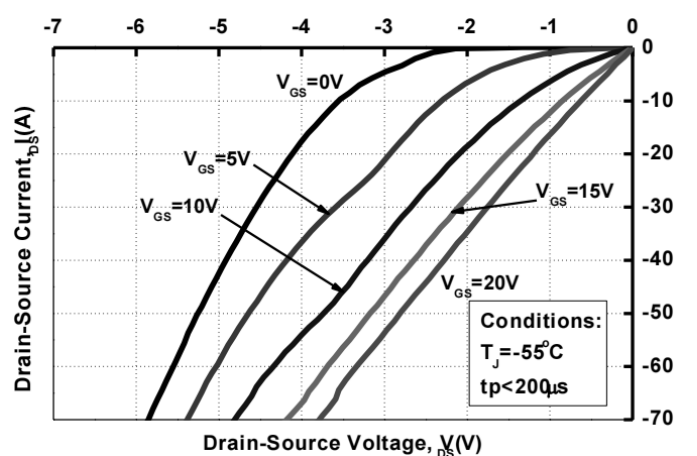
Diagram 12: 3<sup>rd</sup> Quadrant Characteristics at -55°C

Diagram 13: 3<sup>rd</sup> Quadrant Characteristics at 25°C

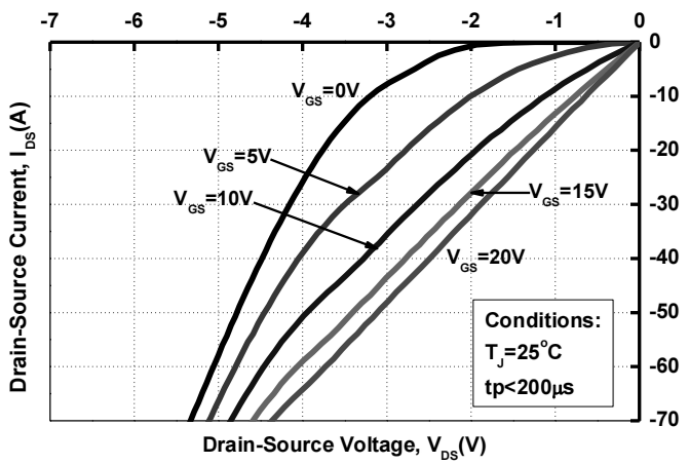


Diagram 14: 3<sup>rd</sup> Quadrant Characteristics at 150°C

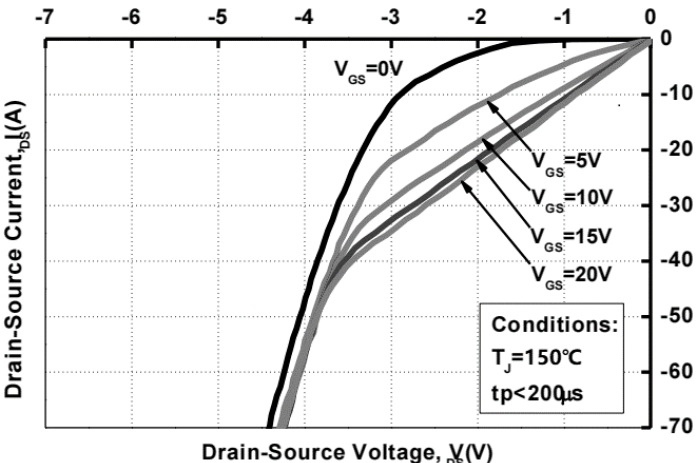


Diagram 15: Capacitance vs. Drain-Source Voltage

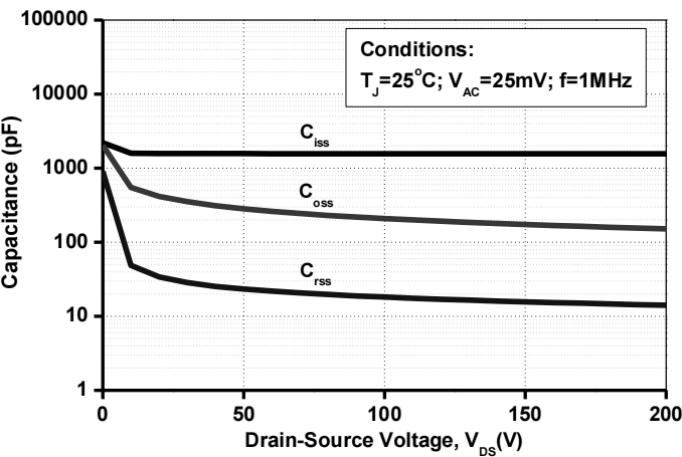
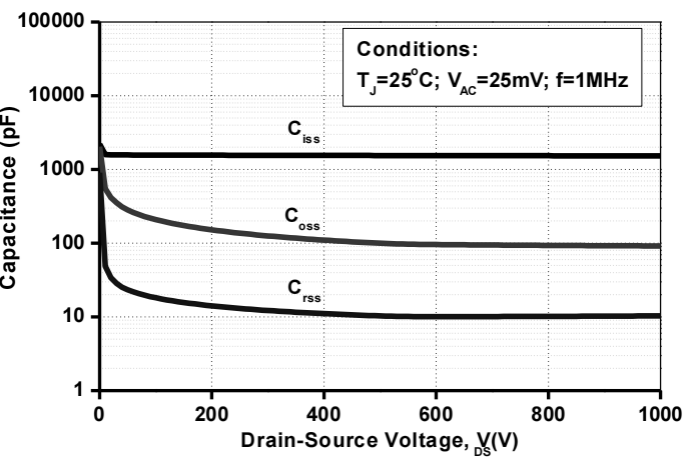


Diagram 16: Capacitance vs. Drain-Source Voltage



6. Test Circuits

Table 7. Diode Characteristics

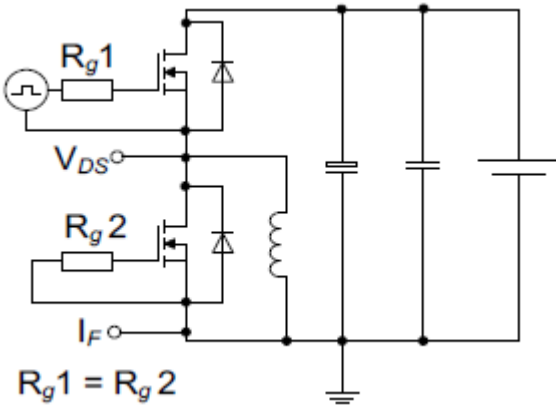
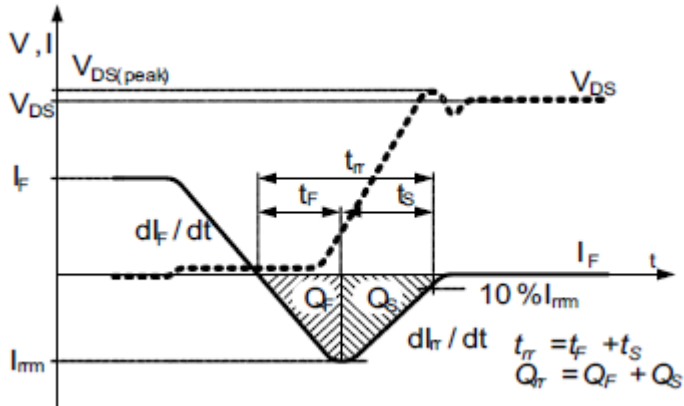
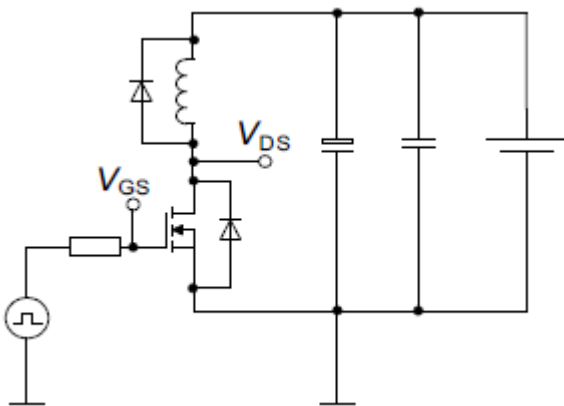
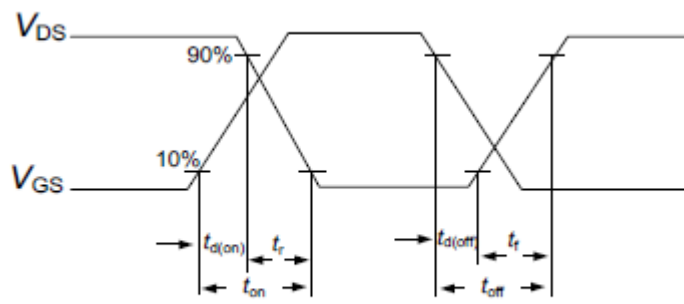
| Test Circuit for Diode Characteristics                                                                                | Diode Recovery Waveform                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><math>R_{g1} = R_{g2}</math></p> |  <p><math>t_{rr} = t_F + t_S</math><br/><math>Q_{rr} = Q_F + Q_S</math></p> |

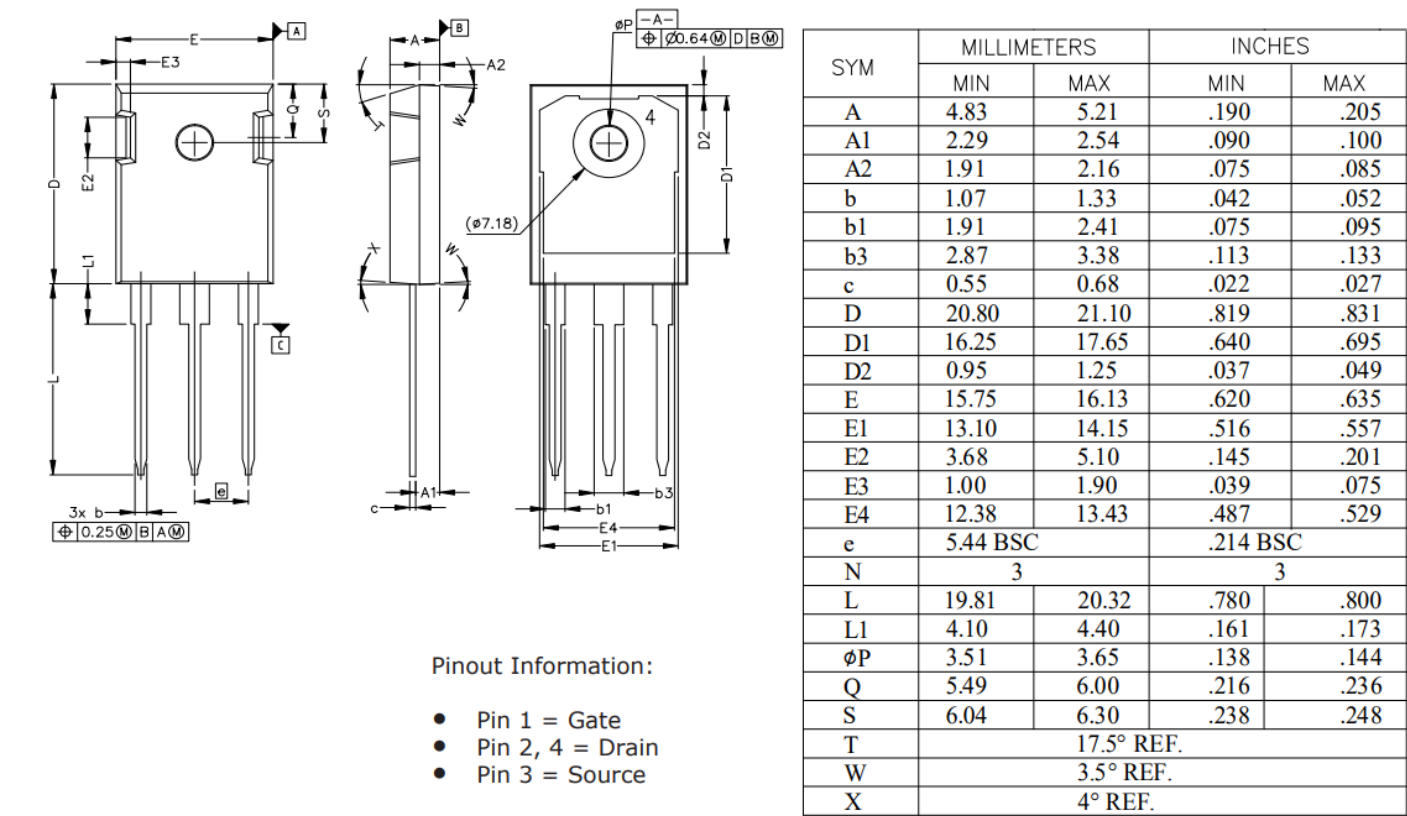
Table 8. Switching Times

| Switching Times Test Circuit for Inductive Load                                    | Switching Times Waveform                                                             |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |



7. Package Outlines

Figure 1 Outline To-247-3 Dimensions in mm



8. Appendix

CoolSemi CoolinSiC Webpage: [www.coolsemi.com](http://www.coolsemi.com).