

# SC020N65YM-R

Silicon Carbide MOSFET 650V, 20mΩ, 91A



重庆平伟半导体股份有限公司

## Features

- Low switching losses
- Extremely low on-resistance  $R_{DS(on)}$
- Robust body diode operation under hard commutation events
- Easy to Parallel and Simple to Drive
- Qualified according to JEDEC criteria

## Applications

- On-board charger
- DC/DC converter
- Auxiliary inverters

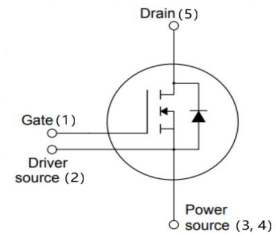
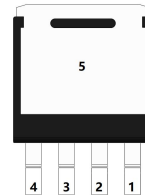
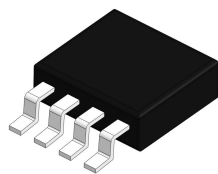


**100% DVDS Tested**  
**100% Avalanche Tested**

## Product Summary

|                   |      |
|-------------------|------|
| $V_{DS}$          | 650V |
| $R_{DS(on)}$ typ. | 20mΩ |
| $I_D$             | 91A  |

TO-247SM



## Package Marking and Ordering Information

| Part #       | Marking    | Package  | Packing   | Reel Size | Tape Width | Qty    |
|--------------|------------|----------|-----------|-----------|------------|--------|
| SC020N65YM-R | SC020N65YM | TO-247SM | Tape&Reel | 13inches  | 32mm       | 600pcs |

## Absolute Maximum Ratings

| Parameter                                                                                         | Symbol                | Value      | Unit             |
|---------------------------------------------------------------------------------------------------|-----------------------|------------|------------------|
| Drain-source voltage                                                                              | $V_{DS}$              | 650        | V                |
| Continuous drain current<br>$T_C = 25^\circ\text{C}$<br>$T_C = 100^\circ\text{C}$ (Silicon limit) | $I_D$                 | 91<br>64   | A                |
| Pulsed drain current ( $T_C = 25^\circ\text{C}$ )                                                 | $I_{D \text{ pulse}}$ | 272        | A                |
| Avalanche energy, single pulse ( $L=5\text{mH}$ )                                                 | $E_{AS}$              | 423        | mJ               |
| Gate-Source voltage,max.transient voltage                                                         | $V_{GSmax}$           | -10/+22    | V                |
| Gate-Source voltage,Recommended operating values                                                  | $V_{GSsop}$           | -5/+18     | V                |
| Power dissipation<br>$T_C = 25^\circ\text{C}$                                                     | $P_{tot}$             | 175        | W                |
| Operating junction and storage temperature                                                        | $T_j, T_{stg}$        | -55...+175 | $^\circ\text{C}$ |

**Thermal Resistance**

| Parameter                                              | Symbol     | Value |      |      | Unit | Test Condition |
|--------------------------------------------------------|------------|-------|------|------|------|----------------|
|                                                        |            | min.  | typ. | max. |      |                |
| Thermal resistance, junction – case.                   | $R_{thJC}$ | -     | 0.57 | 0.86 | °C/W | -              |
| Thermal resistance, junction - ambient(min. footprint) | $R_{thJA}$ | -     | -    | 50   | °C/W | -              |

**Electrical Characteristic (at  $T_j = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)**

| Parameter | Symbol | Value |      |      | Unit | Test Condition |
|-----------|--------|-------|------|------|------|----------------|
|           |        | min.  | typ. | max. |      |                |

**Static Characteristic**

|                                  |              |     |     |      |         |                                                                     |
|----------------------------------|--------------|-----|-----|------|---------|---------------------------------------------------------------------|
| Drain-source breakdown voltage   | $BV_{DSS}$   | 650 | -   | -    | V       | $V_{GS}=0V, I_D=100\mu A$                                           |
| Gate threshold voltage           | $V_{GS(th)}$ | 2.2 | 3.0 | 4.2  | V       | $V_{DS}=V_{GS}, I_D=10mA$                                           |
| Zero gate voltage drain current  | $I_{DSS}$    | -   | 1   | 10   | $\mu A$ | $V_{DS}=650V, V_{GS}=0V$<br>$T_j=25^{\circ}C$<br>$T_j=175^{\circ}C$ |
| Gate-source leakage current      | $I_{GSS}$    | -   | -   | 100  | nA      | $V_{GS}=22V, V_{DS}=0V$                                             |
|                                  |              | -   | -   | -100 | nA      | $V_{GS}=-13V, V_{DS}=0V$                                            |
| Drain-source on-state resistance | $R_{DS(on)}$ | -   | 20  | 28   | mΩ      | $V_{GS}=18V, I_D=20A$                                               |
| Transconductance                 | $g_{fs}$     | -   | 10  | -    | S       | $V_{DS}=18V, I_D=10A$                                               |

**Dynamic Characteristic**

|                              |              |   |      |   |    |                                                              |
|------------------------------|--------------|---|------|---|----|--------------------------------------------------------------|
| Input Capacitance            | $C_{iss}$    | - | 2977 | - | pF | $V_{GS}=0V, V_{DS}=400V,$<br>$f=1MHz$                        |
| Output Capacitance           | $C_{oss}$    | - | 186  | - |    |                                                              |
| Reverse Transfer Capacitance | $C_{rss}$    | - | 9    | - |    |                                                              |
| Gate Total Charge            | $Q_G$        | - | 131  | - | nC | $V_{DS}=400V, I_D=20A$<br>$V_{GS}=-5V/18V$                   |
| Gate-Source charge           | $Q_{gs}$     | - | 49   | - |    |                                                              |
| Gate-Drain charge            | $Q_{gd}$     | - | 28   | - |    |                                                              |
| Turn-on delay time           | $t_{d(on)}$  | - | 15   | - | ns | $V_{GS}=-5/18V,$<br>$V_{DD}=400V,$<br>$R_G=5\Omega, I_D=20A$ |
| Rise time                    | $t_r$        | - | 45   | - |    |                                                              |
| Turn-off delay time          | $t_{d(off)}$ | - | 13   | - |    |                                                              |
| Fall time                    | $t_f$        | - | 10   | - |    |                                                              |
| Gate resistance              | $R_G$        | - | 1.5  | - | Ω  | $V_{GS}=0V, f=1MHz$                                          |

**Body Diode Characteristic**

| Parameter                             | Symbol    | Value  |            |        | Unit | Test Condition                                                              |
|---------------------------------------|-----------|--------|------------|--------|------|-----------------------------------------------------------------------------|
|                                       |           | min.   | typ.       | max.   |      |                                                                             |
| Body Diode Forward Voltage            | $V_{SD}$  | -<br>- | 3.4<br>3.1 | -<br>- | V    | $V_{GS} = -5V, I_{SD} = 20A$<br>$T_j = 25^{\circ}C$<br>$T_j = 175^{\circ}C$ |
| Body Diode Continuous Forward Current | $I_S$     | -      | -          | 86     | A    | $T_C = 25^{\circ}C$                                                         |
|                                       |           | -      | -          | 48     | A    | $T_C = 100^{\circ}C$                                                        |
| Body Diode Reverse Recovery Time      | $t_{rr}$  | -      | 17         | -      | ns   | $V_{GS} = -5V, I_{SD} = 20A,$<br>$V_R = 400V$<br>$di/dt = 1200A/us$         |
| Body Diode Reverse Recovery Charge    | $Q_{rr}$  | -      | 112        | -      | nC   |                                                                             |
| Peak Reverse Recovery Current         | $I_{RRM}$ | -      | 11         | -      | A    |                                                                             |

## Typical Performance Characteristics

Fig 1: Output Characteristics  $T_j=25^\circ\text{C}$

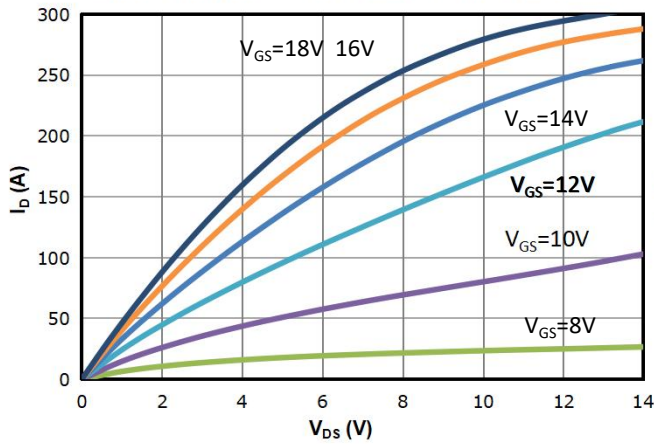


Fig 2: Output Characteristics  $T_j=175^\circ\text{C}$

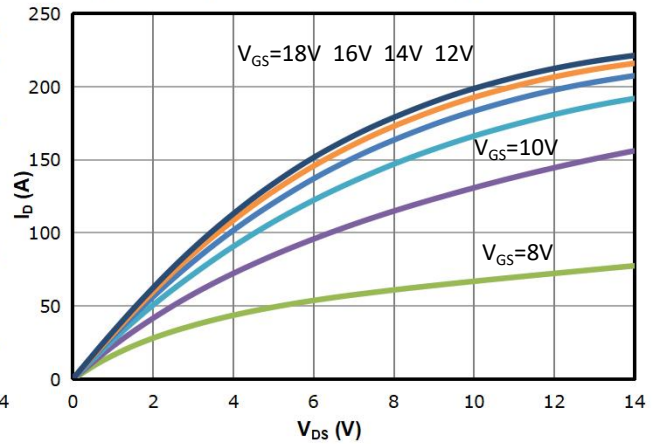


Fig 3: Transfer Characteristics

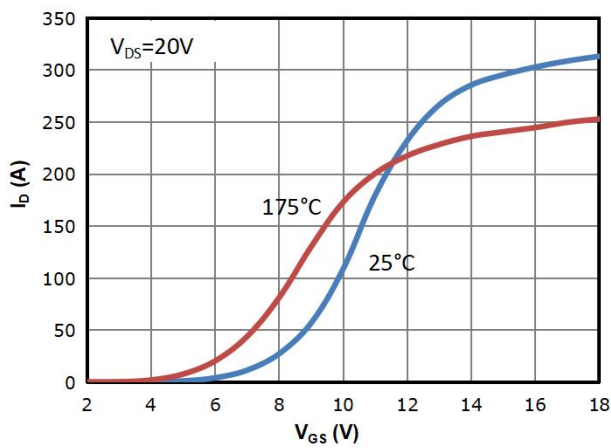


Fig 4:  $R_{DS(on)}$  vs Drain Current and Gate Voltage

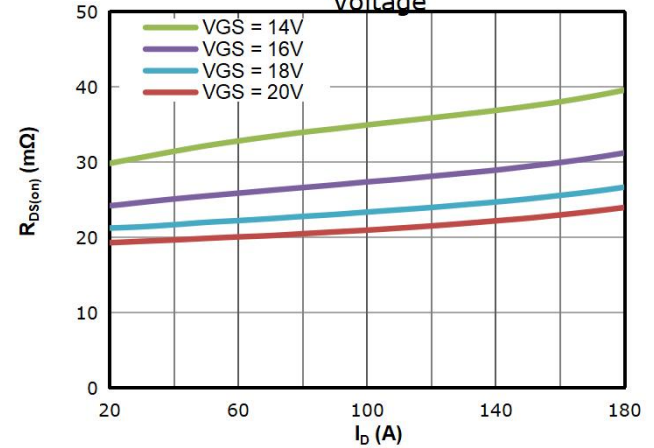


Fig 5:  $R_{DS(on)}$  vs. Temperature

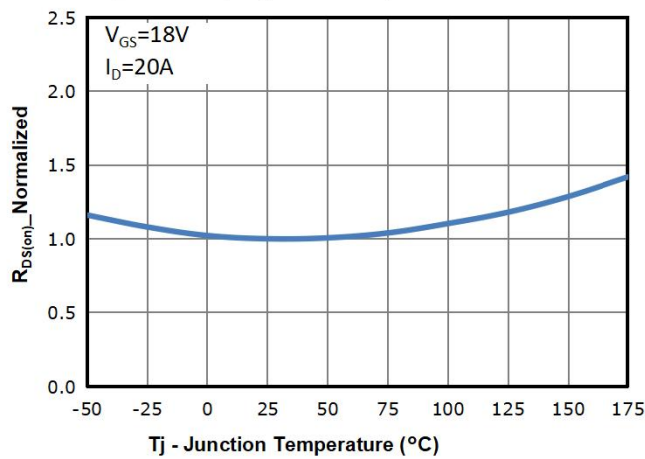


Fig 6:  $V_{GS(th)}$  vs. Temperature

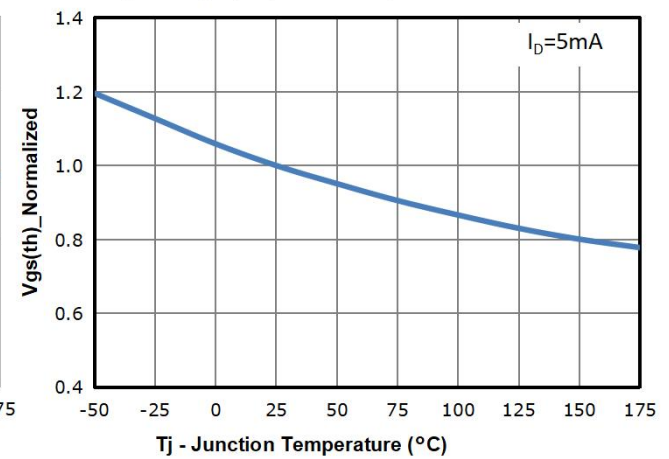


Fig 7: BVdss vs. Temperature

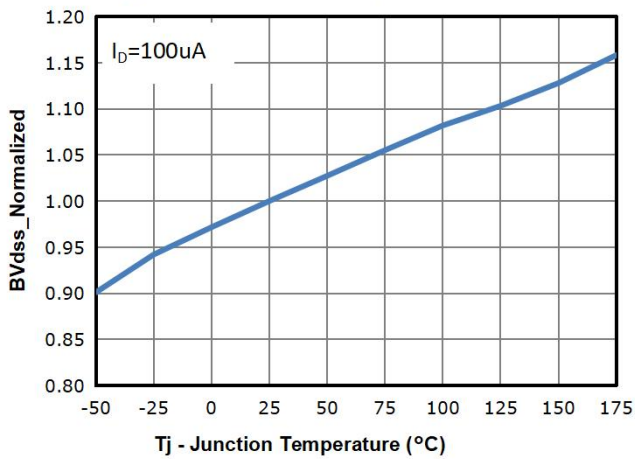


Fig 8: Capacitance Characteristics

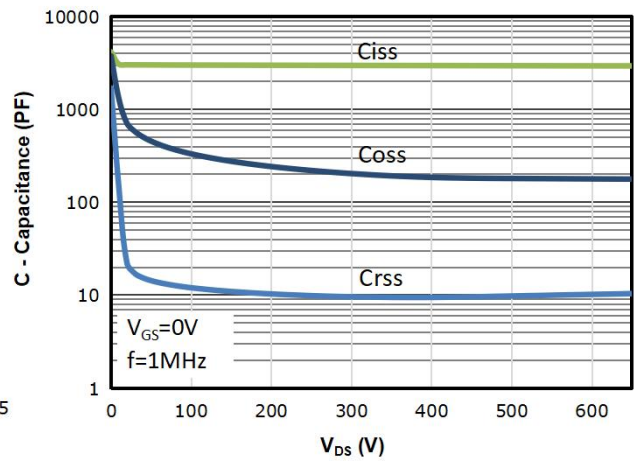


Fig 9: Gate Charge Characteristics

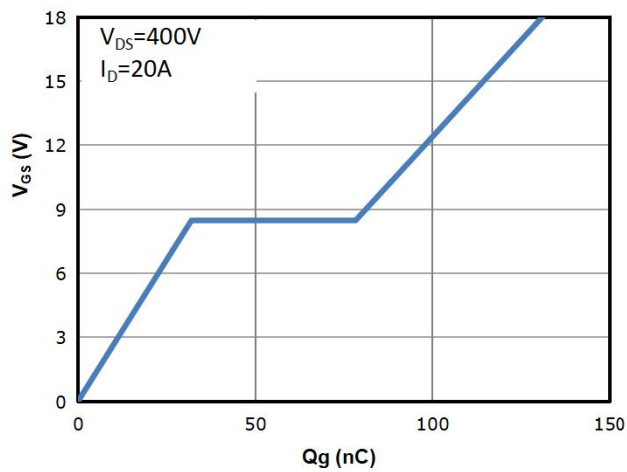


Fig 10: Body-diode Forward Characteristics

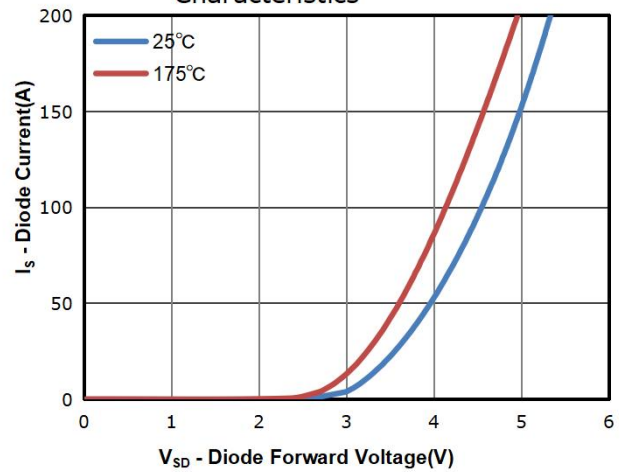


Fig 11: Power Dissipation

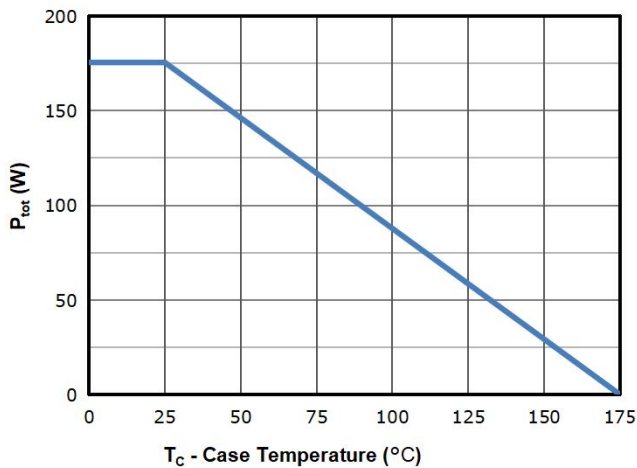


Fig 12: Drain Current Derating

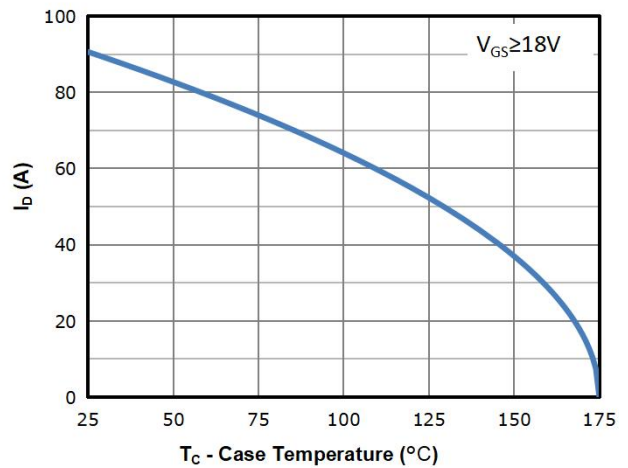




Fig 13: Safe Operating Area

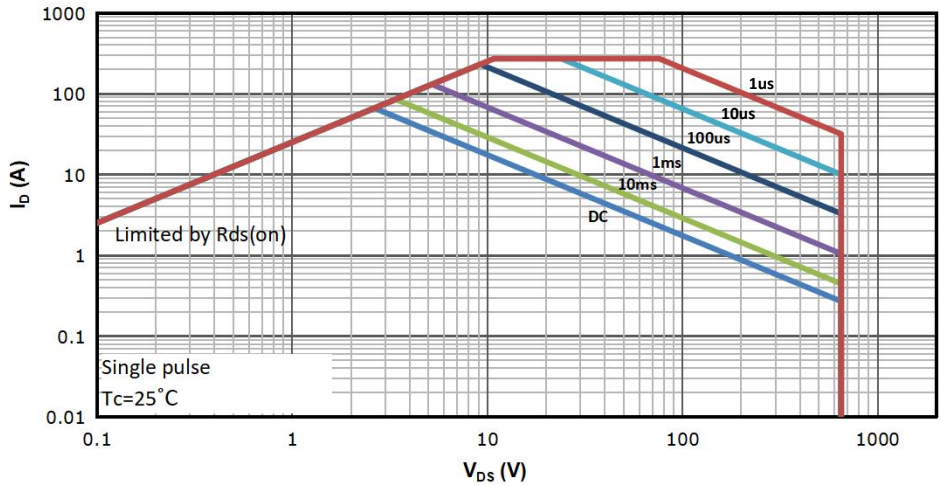
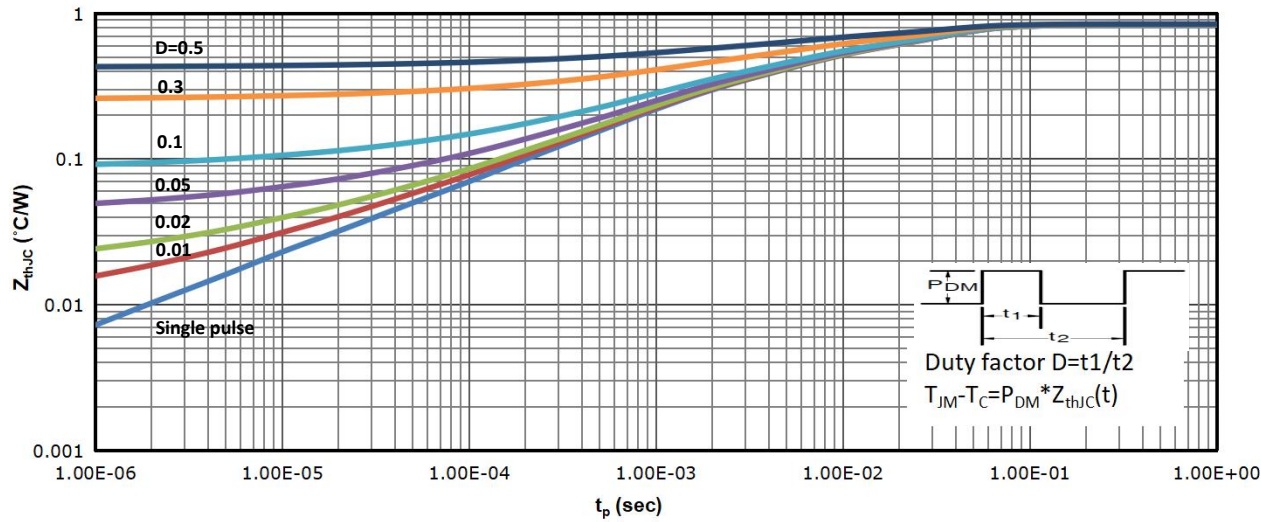
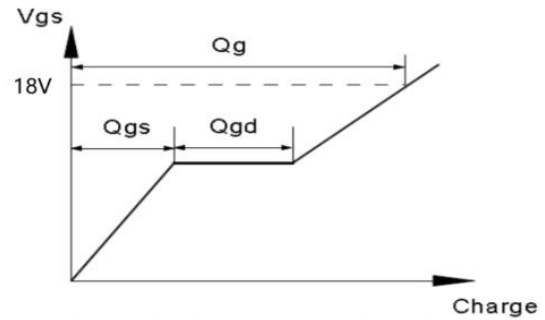
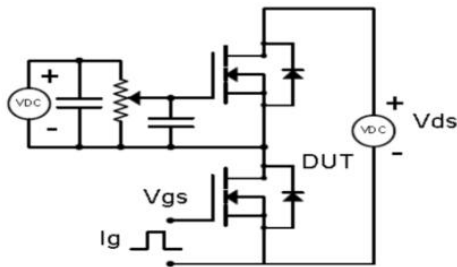


Fig 14: Max. Transient Thermal Impedance

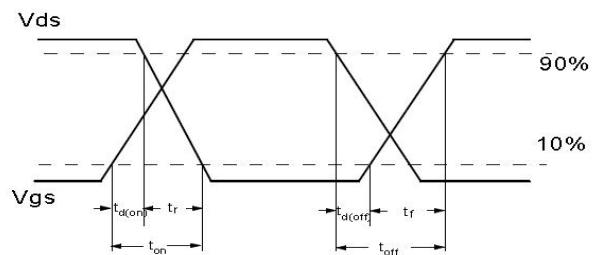
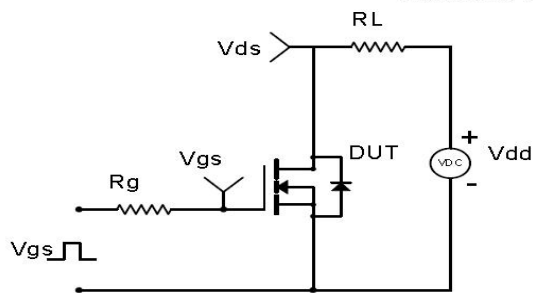


### Test Circuit & Waveform

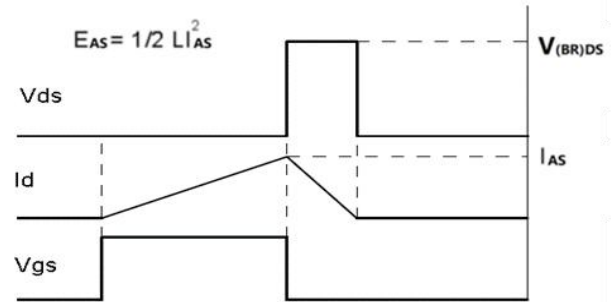
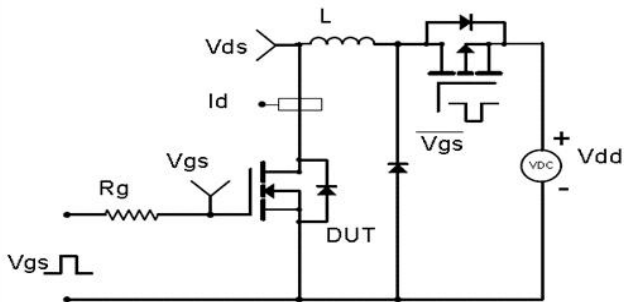
Gate Charge Test Circuit & Waveform



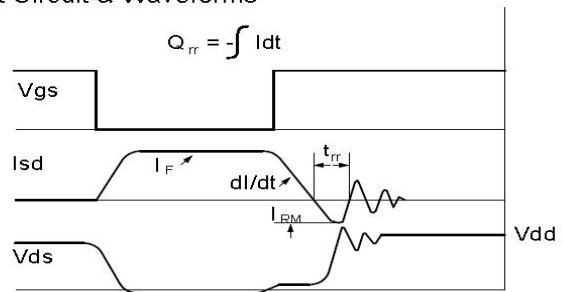
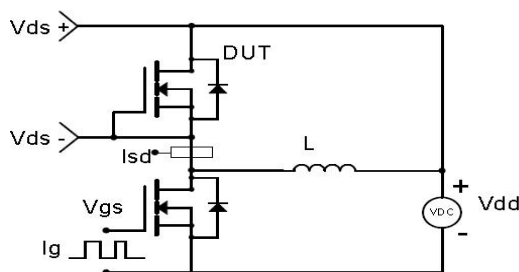
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



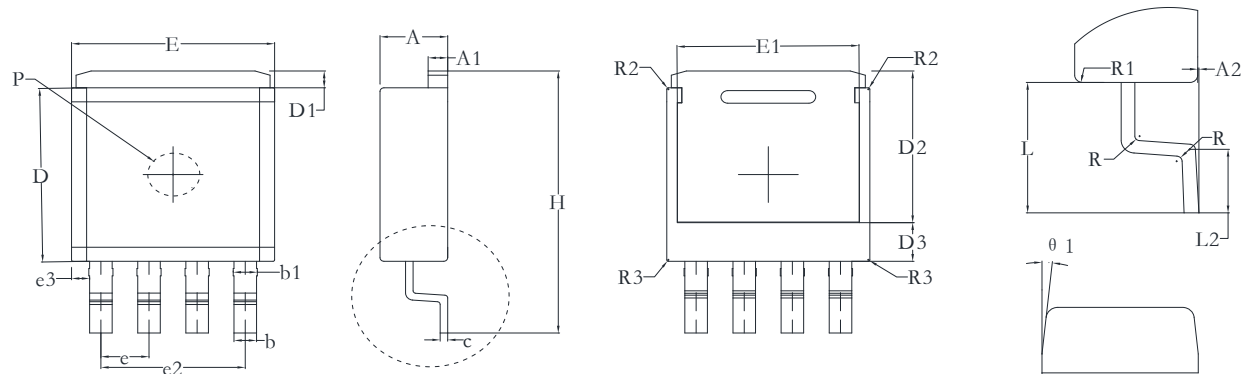
# SC020N65YM-R

Silicon Carbide MOSFET 650V, 20mΩ, 91A



重庆平伟半导体股份有限公司

## Package Outline: TO-247SM



| SYMBOL | MILLIMETERS |       | INCHES |       |
|--------|-------------|-------|--------|-------|
|        | MIN         | MAX   | MIN    | MAX   |
| A      | 4.35        | 4.65  | 0.171  | 0.183 |
| A1     | 1.20        | 1.40  | 0.047  | 0.055 |
| b      | 1.45        | 1.55  | 0.057  | 0.061 |
| b1     | 1.50        | 1.70  | 0.059  | 0.067 |
| c      | 0.45        | 0.55  | 0.018  | 0.022 |
| D      | 12.28       | 12.48 | 0.483  | 0.491 |
| D1     | 1.10        | 1.30  | 0.043  | 0.051 |
| D2     | 10.63       | 10.83 | 0.419  | 0.426 |
| E      | 13.40       | 13.60 | 0.528  | 0.535 |
| E1     | 12.00       | 12.20 | 0.472  | 0.480 |
| e      | 3.16        | 3.24  | 0.124  | 0.128 |
| e2     | 9.45        | 9.75  | 0.372  | 0.384 |
| e3     | 1.16        | 1.24  | 0.046  | 0.049 |
| H      | 18.40       | 19.00 | 0.724  | 0.748 |
| L      | 4.82        | 5.42  | 0.190  | 0.213 |
| L2     | 1.70        | 2.30  | 0.067  | 0.091 |
| R      | 0.35        | 0.65  | 0.014  | 0.026 |
| θ1     | 6°          | 10°   | 6°     | 10°   |
| P      | 2.85        | 3.15  | 0.112  | 0.124 |
| D3     | 2.65        | 2.95  | 0.104  | 0.116 |
| A2     | 0.10        | 0.20  | 0.004  | 0.008 |
| R1     | 0.75        | 0.85  | 0.030  | 0.033 |
| R2     | 0.15        | 0.25  | 0.006  | 0.010 |
| R3     | 0.05        | 0.15  | 0.002  | 0.006 |

## Disclaimer

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