

# SC020N65DT-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

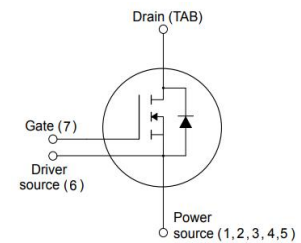
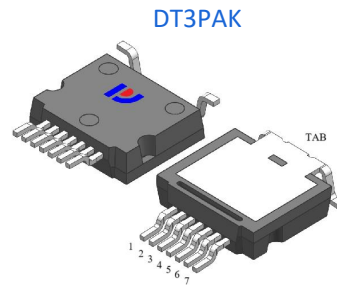
- On-board charger
- DC/DC converter
- Auxiliary inverters



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

## Product Summary

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



## Package Marking and Ordering Information

| Part #       | Marking    | Package | Packing   | Reel Size | Tape Width | Qty |
|--------------|------------|---------|-----------|-----------|------------|-----|
| SC020N65DT-R | SC020N65DT | DT3PAK  | Tape&Reel | 13 inches | 32mm       | 550 |

## 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>$T_C = 25^\circ\text{C}$ (Package limit)<br>$T_C = 100^\circ\text{C}$ (Silicon limit) | $I_D$                 | 91<br>124<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>$T_C = 25^\circ\text{C}$                                                                                                 | $P_{tot}$             | 238             | 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.                   | $R_{thJC}$ | -     | 0.42 | 0.63 | °C/W | -              |
| Thermal resistance, junction - ambient(min. footprint) | $R_{thJA}$ | -     | -    | 56   | °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>$T_j=25^{\circ}C$ |
|                                  |              | -   | -   | 100  | $\mu A$ | $T_j=175^{\circ}C$                            |
| 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  | $V_{GS}=0V, f=1MHz$                                          |

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## Body Diode Characteristic

| Parameter                             | Symbol    | Value |      |      | Unit | Test Condition                                                      |
|---------------------------------------|-----------|-------|------|------|------|---------------------------------------------------------------------|
|                                       |           | min.  | typ. | max. |      |                                                                     |
| Body Diode Forward Voltage            | $V_{SD}$  | -     | 3.4  | -    | V    | $V_{GS} = -5V, I_{SD} = 20A$<br>$T_j = 25^{\circ}C$                 |
|                                       |           | -     | 3.1  | -    |      | $T_j = 175^{\circ}C$                                                |
| 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  $T_j=25^\circ\text{C}$

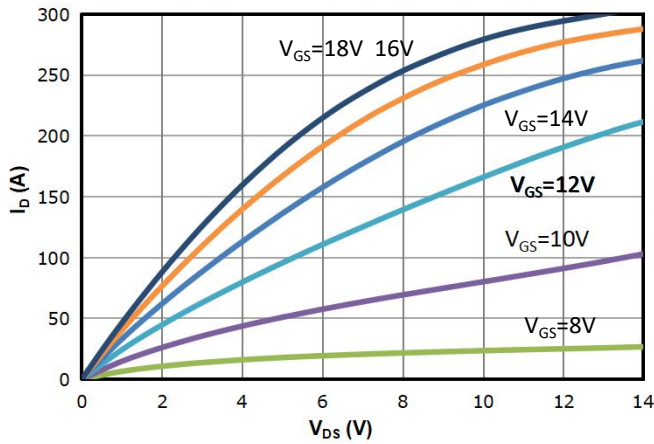


Fig 2: Output Characteristics  $T_j=175^\circ\text{C}$

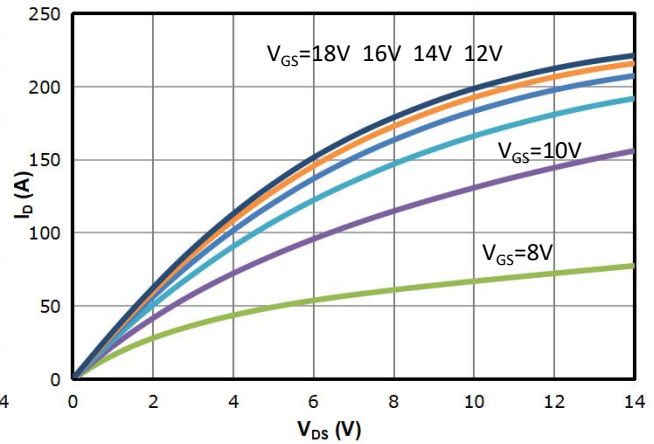


Fig 3: Transfer Characteristics

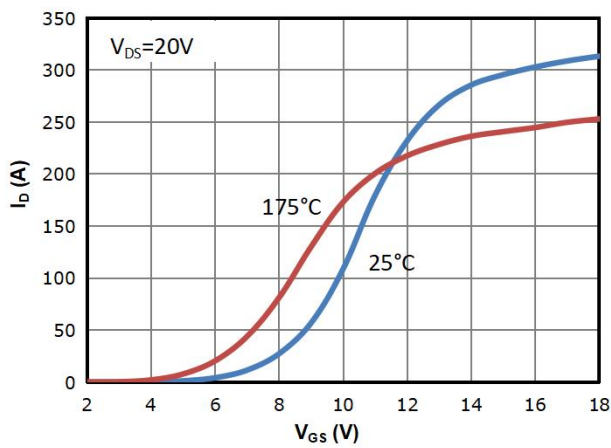


Fig 4:  $R_{DS(on)}$  vs Drain Current and Gate Voltage

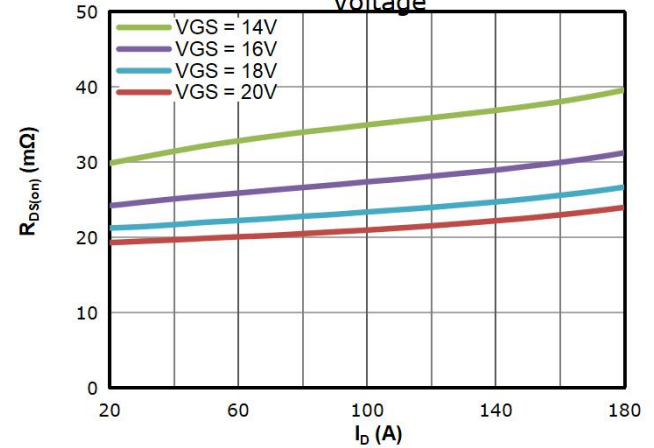


Fig 5:  $R_{DS(on)}$  vs. Temperature

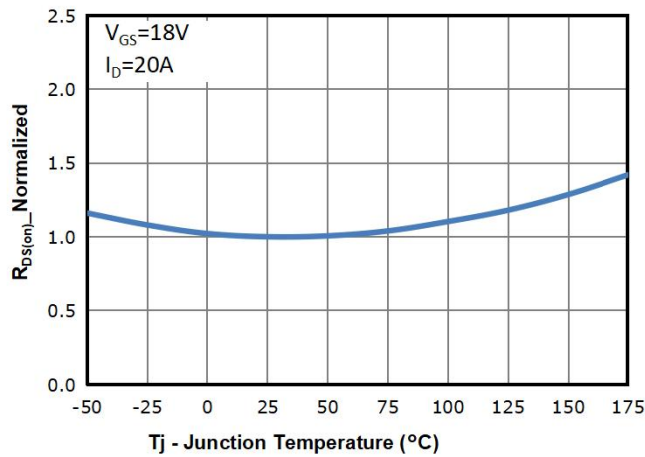


Fig 6:  $V_{GS(th)}$  vs. Temperature

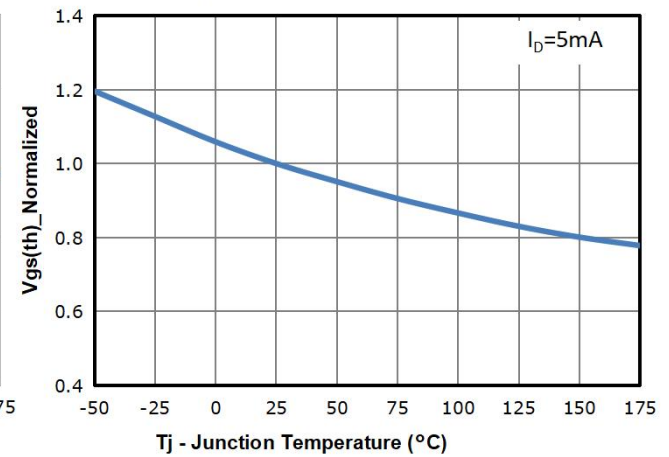


Fig 7: BVdss vs. Temperature

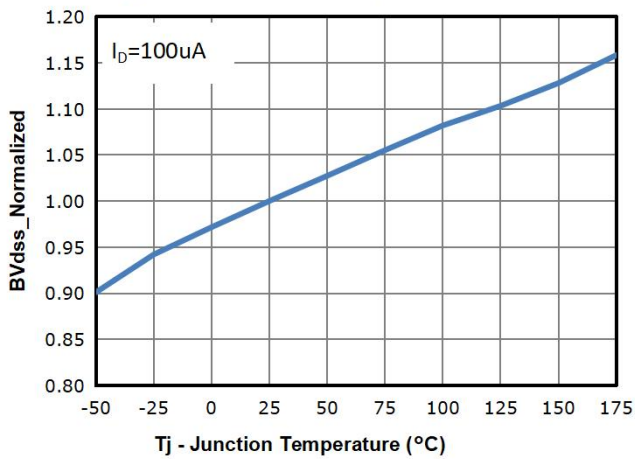


Fig 8: Capacitance Characteristics

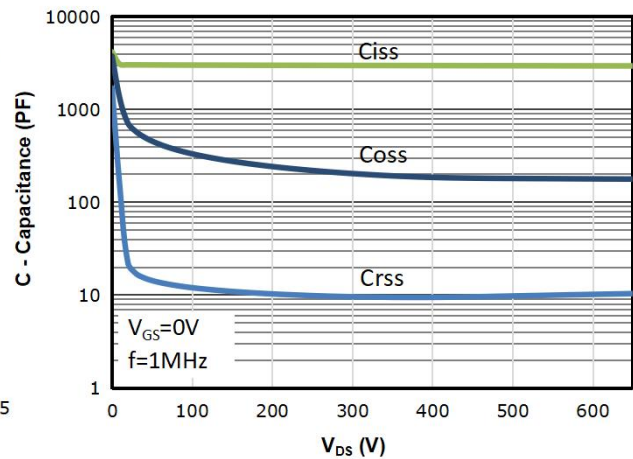


Fig 9: Gate Charge Characteristics

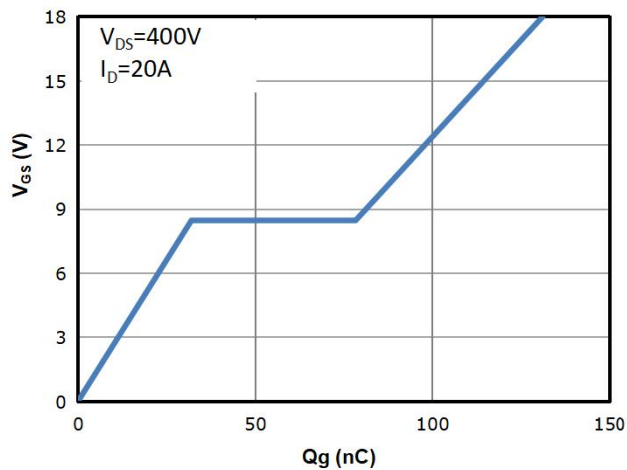


Fig 10: Body-diode Forward Characteristics

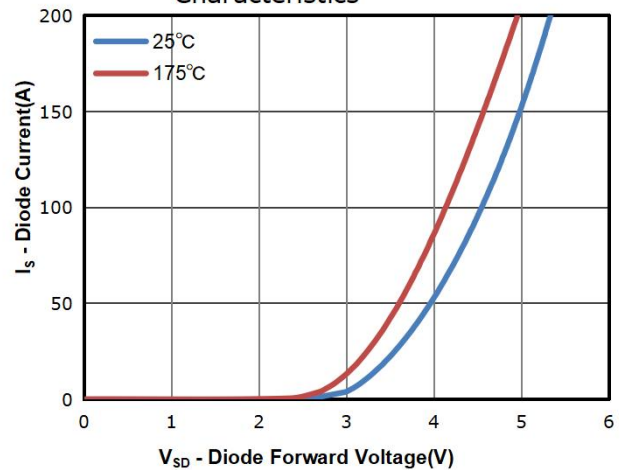


Fig 11: Power Dissipation

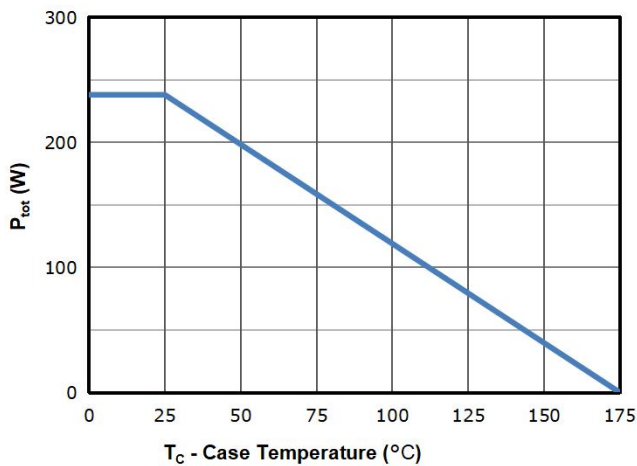


Fig 12: Drain Current Derating

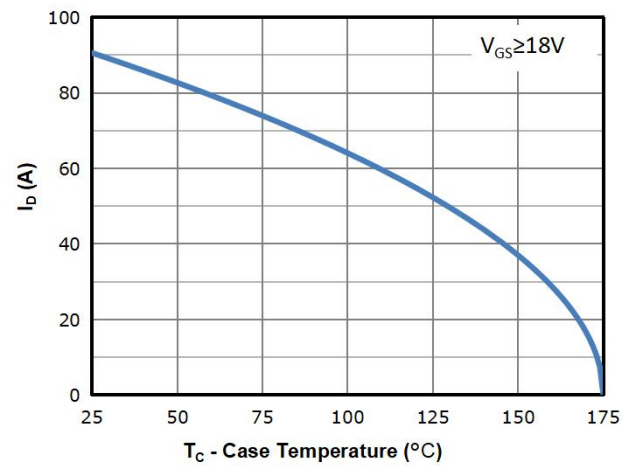




Fig 13: Safe Operating Area

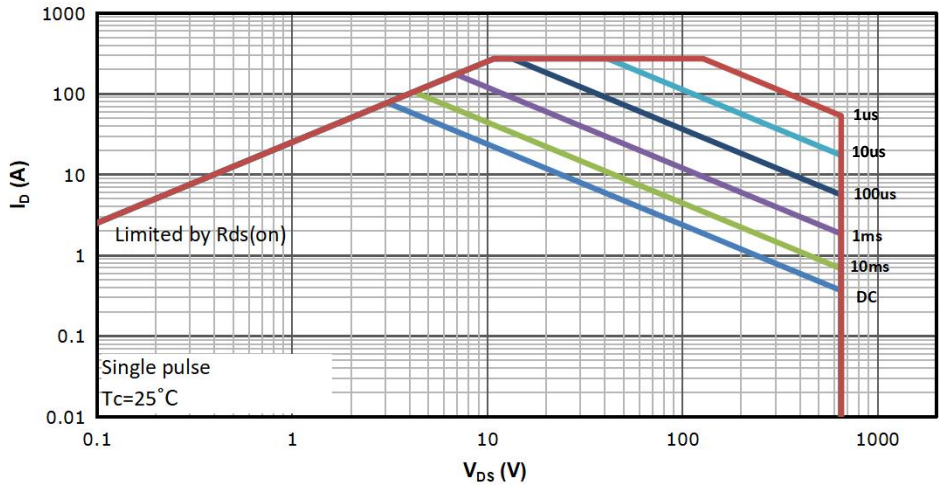
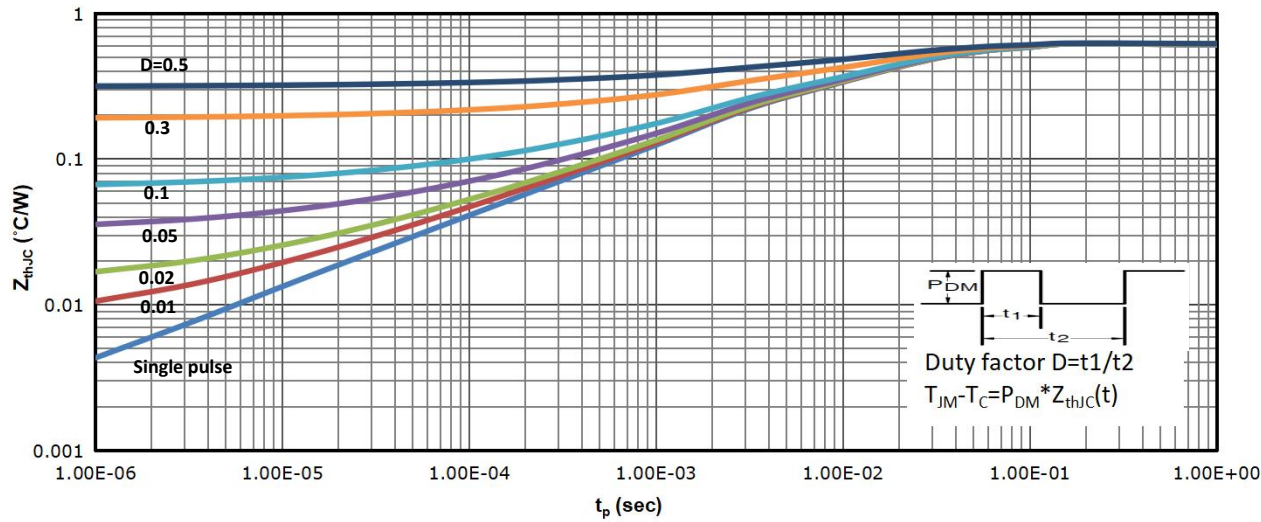
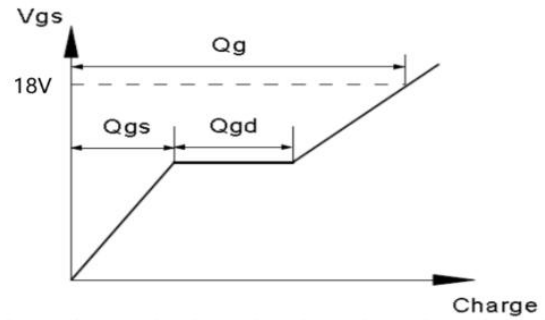
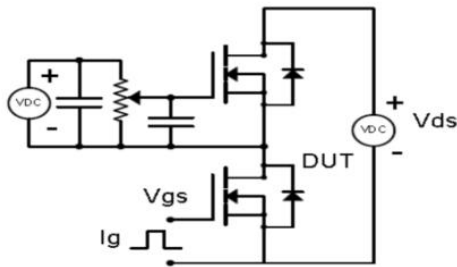


Fig 14: Max. Transient Thermal Impedance

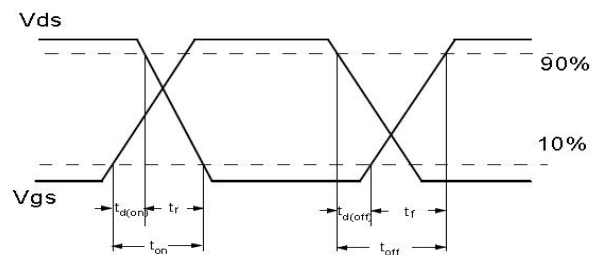
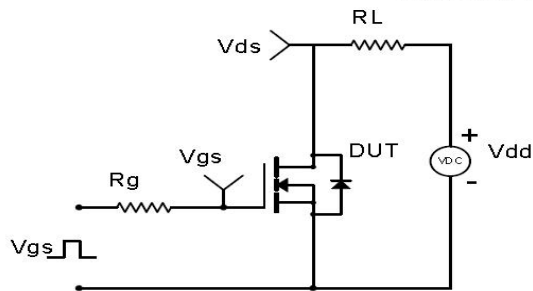


## Test Circuit & Waveform

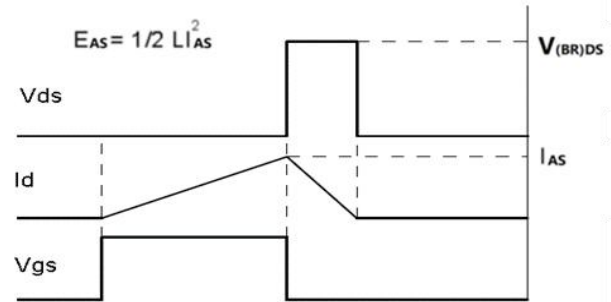
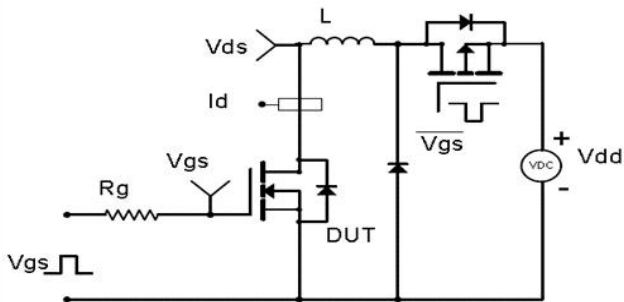
Gate Charge Test Circuit & Waveform



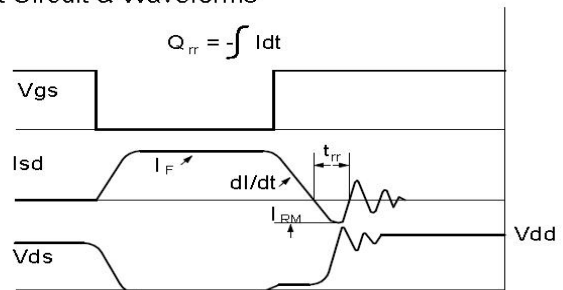
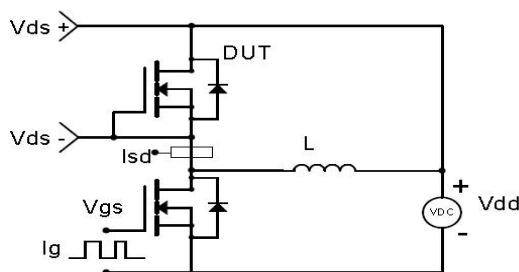
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



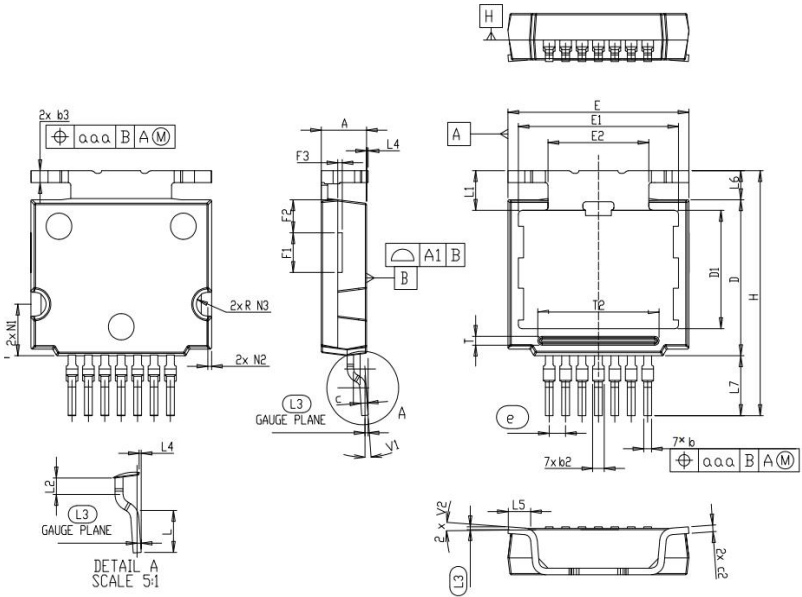
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## Package Outline: DT3PAK



| DIMENSIONS | MILLIMETERS |       | INCHES |       |
|------------|-------------|-------|--------|-------|
|            | MIN.        | MAX.  | MIN.   | MAX.  |
| A          | 3.40        | 3.60  | 0.134  | 0.142 |
| A1         | 0.50        |       | 0.020  |       |
| b          | 0.50        | 0.70  | 0.020  | 0.028 |
| b2         | 0.50        | 1.00  | 0.020  | 0.039 |
| b3         | 0.80        | 1.00  | 0.031  | 0.039 |
| C          | 0.40        | 0.60  | 0.016  | 0.024 |
| C2         | 0.40        | 0.60  | 0.016  | 0.024 |
| D          | 11.70       | 11.90 | 0.461  | 0.469 |
| D1         | 8.80        | 9.10  | 0.346  | 0.358 |
| E          | 13.90       | 14.10 | 0.547  | 0.555 |
| E1         | 12.30       | 12.50 | 0.484  | 0.492 |
| E2         | 7.75        | 7.85  | 0.305  | 0.309 |
| e          | 1.27        |       | 0.050  |       |
| H          | 18.00       | 19.00 | 0.709  | 0.748 |
| L          | 2.40        | 2.60  | 0.094  | 0.102 |
| L1         | 3.05        |       | 0.120  |       |
| L2         | 0.90        | 1.10  | 0.035  | 0.043 |
| L3         | 0.26        |       | 0.010  |       |
| L4         | 0.075       | 0.175 | 0.003  | 0.007 |
| L5         | 1.83        | 2.03  | 0.072  | 0.080 |
| L6         | 2.14        | 2.34  | 0.084  | 0.092 |
| L7         | 4.44        | 4.64  | 0.175  | 0.183 |
| F1         | 2.90        | 3.10  | 0.114  | 0.122 |
| F2         | 2.40        | 2.60  | 0.094  | 0.102 |
| F3         | 0.25        | 0.45  | 0.010  | 0.018 |
| N1         | 3.80        | 4.00  | 0.150  | 0.157 |
| N2         | 0.25        | 0.45  | 0.010  | 0.018 |
| N3         | 0.80        | 1.00  | 0.031  | 0.039 |
| T          | 0.50        | 0.70  | 0.020  | 0.028 |
| T2         | 9.18        | 9.43  | 0.361  | 0.371 |
| V1         | 0°          | 8°    | 0°     | 8°    |
| V2         | 0°          | 8°    | 0°     | 8°    |

## Disclaimer

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