# CRSQ113N20N

SkyMOS3 N-MOSFET 200V, 8.8mΩ, 110A

## Features

- Uses CRM(CQ) advanced SkyMOS3 technology
- Extremely low on-resistance RDS(on)
- Excellent QgxRDS(on) product(FOM)
- Qualified according to JEDEC criteria

## Applications

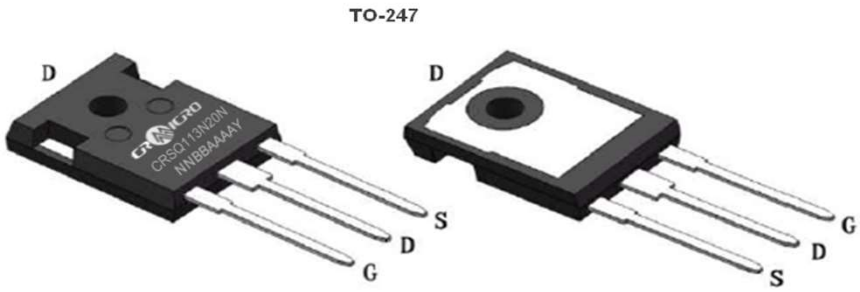
- Motor control and drive
- Battery management
- UPS (Uninterrupible Power Supplies)

## Product Summary

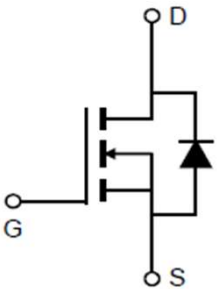
| | |
|---|---|
| $V_{DS}$ | 200V |
| $R_{DS(on)}$ | 8.8mΩ |
| $I_D$ | 110A |

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

RoHS HF




CRSQ113N20N




## Package Marking and Ordering Information

| Part # | Marking | Package | Packing | Reel Size | Tape Width | Qty |
|---|---|---|---|---|---|---|
| CRSQ113N20N | - | TO-247 | Tube | N/A | N/A | 30pcs |

## Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-source voltage | $V_{DS}$ | 200 | V |
| Continuous drain current<br>$T_C$ = 25°C (Silicon limit)<br>$T_C$ = 25°C (Package limit)<br>$T_C$ = 100°C (Silicon limit) | $I_D$ | <br>110<br>160<br>71 | A |
| Pulsed drain current ($T_C$ = 25°C, $t_p$ limited by $T_{jmax}$) | $I_{D\ pulse}$ | 440 | A |
| Avalanche energy, single pulse (L=0.5mH, Rg=25Ω)[1] | $E_{AS}$ | 324 | mJ |
| Gate-Source voltage | $V_{GS}$ | ±20 | V |
| Power dissipation ($T_C$ = 25°C) | $P_{tot}$ | 298 | W |
| Operating junction and storage temperature | $T_j$ , $T_{stg}$ | -55...+150 | °C |

※. Notes:1.EAS is tested at starting Tj = 25℃, L = 0.5mH, IAS = 36A, Vgs=10V.


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## Thermal Resistance

| Parameter | Symbol | Max | Unit |
|---|---|---|---|
| Thermal resistance, junction – case. | $R_{thJC}$ | 0.42 | °C/W |
| Thermal resistance, junction – ambient(min. footprint) | $R_{thJA}$ | 45 | |

## Electrical Characteristic (at Tj = 25 °C, unless otherwise specified)

| Parameter | Symbol | Value | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | min. | typ. | max. | | |
| **Static Characteristic** | | | | | | |
| Drain-source breakdown voltage | $BV_{DSS}$ | 200 | - | - | V | $V_{GS}$=0V, $I_D$=250uA |
| Gate threshold voltage | $V_{GS(th)}$ | 2.2 | 3 | 3.8 | V | $V_{DS}$=$V_{GS}$,$I_D$=250uA |
| Zero gate voltage drain current | $I_{DSS}$ | -<br>- | -<br>- | 1<br>100 | μA | $V_{DS}$=200V,$V_{GS}$=0V<br>$T_j$=25°C<br>$T_j$=125°C |
| Gate-source leakage current | $I_{GSS}$ | - | ±10 | ±100 | nA | $V_{GS}$=±20V,$V_{DS}$=0V |
| Drain-source on-state resistance | $R_{DS(on)}$ | - | 8.8 | 10.6 | mΩ | $V_{GS}$=10V, $I_D$=60A |
| Transconductance | $g_{fs}$ | - | 103.5 | - | S | $V_{DS}$=5V,$I_D$=60A |
| **Dynamic Characteristic** | | | | | | |
| Input Capacitance | $C_{iss}$ | - | 5267.7 | - | pF | $V_{GS}$=0V, $V_{DS}$=100V, f=1MHz |
| Output Capacitance | $C_{oss}$ | - | 461.7 | - | | |
| Reverse Transfer Capacitance | $C_{rss}$ | - | 24.3 | - | | |
| Gate Total Charge | $Q_G$ | - | 74.0 | - | nC | $V_{GS}$=10V, $V_{DS}$=100V, $I_D$=60A, f=1MHz |
| Gate-Source charge | $Q_{gs}$ | - | 29.8 | - | | |
| Gate-Drain charge | $Q_{gd}$ | - | 16.3 | - | | |
| Turn-on delay time | $t_{d(on)}$ | - | 35 | - | ns | $V_{GS}$=10V, $V_{DD}$=100V, $R_{G_ext}$=2.7Ω |
| Rise time | $t_r$ | - | 111 | - | | |
| Turn-off delay time | $t_{d(off)}$ | - | 84 | - | | |
| Fall time | $t_f$ | - | 112 | - | | |
| Gate resistance | $R_G$ | - | 3.5 | - | Ω | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz |

## Body Diode Characteristic


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| Parameter | Symbol | Value | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | min. | typ. | max. | | |
| Body Diode Forward Voltage | $V_{SD}$ | - | 0.89 | 1.3 | V | $V_{GS}$=0V,$I_{SD}$=60A |
| Body Diode Reverse Recovery Time | $t_{rr}$ | - | 150.8 | - | ns | $I_F$=60A, dI/dt=100A/us Vds=100V |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | - | 779.4 | - | nC | |


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## Typical Performance Characteristics

Fig 1: Output Characteristics

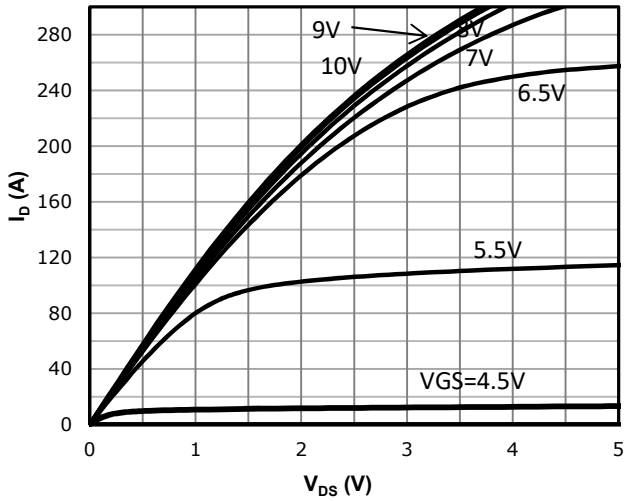



Fig 2: Transfer Characteristics

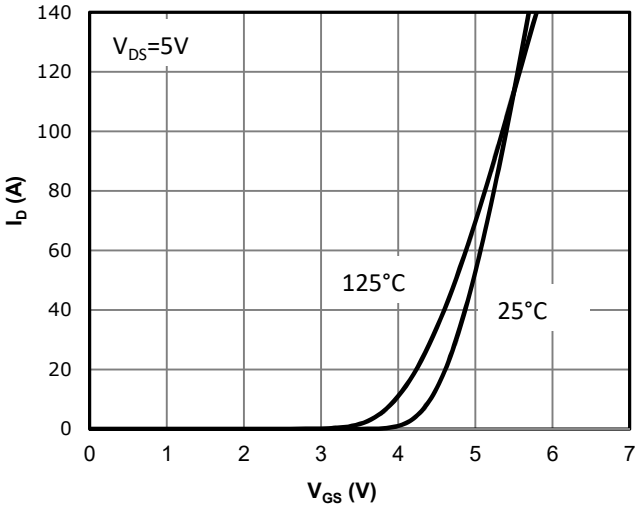



Fig 3: Rds(on) vs Drain Current and Gate Voltage

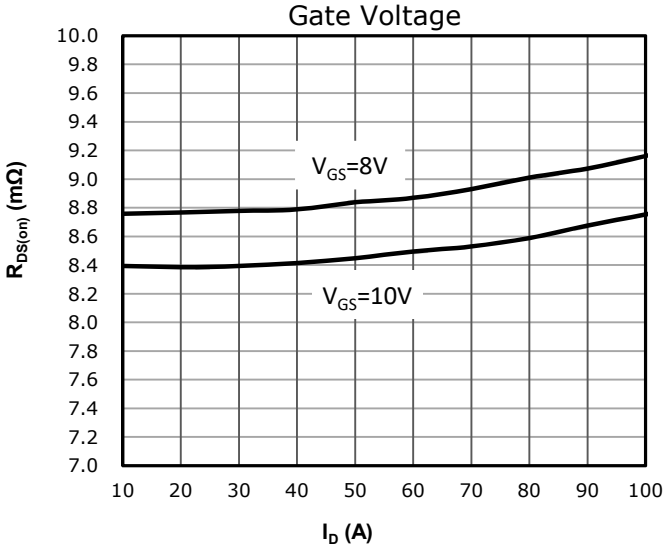



Fig 4: Rds(on) vs Gate Voltage

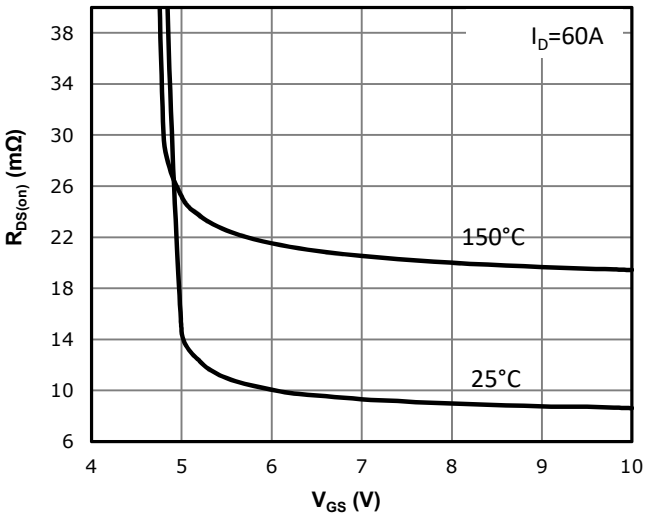



Fig 5: Rds(on) vs. Temperature

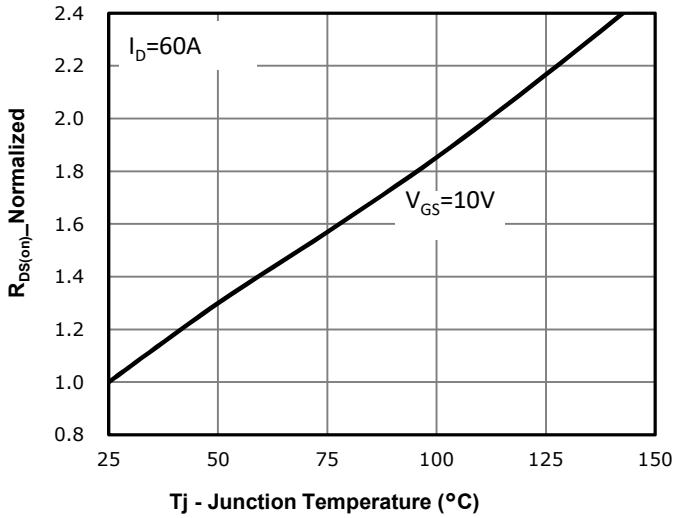
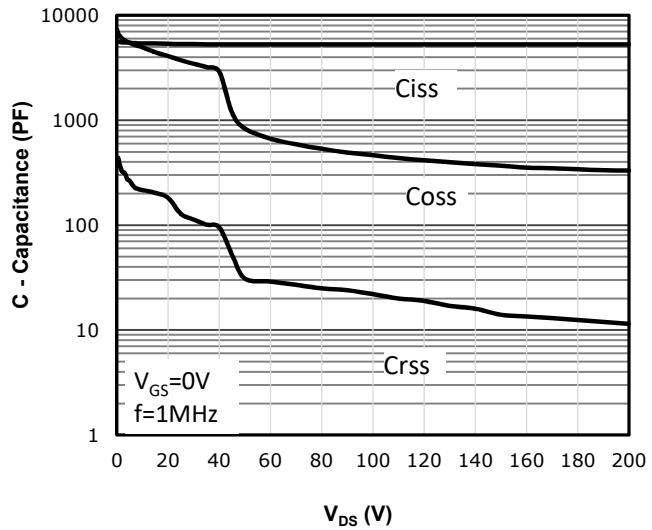



Fig 6: Capacitance Characteristics





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Fig 7: Gate Charge Characteristics

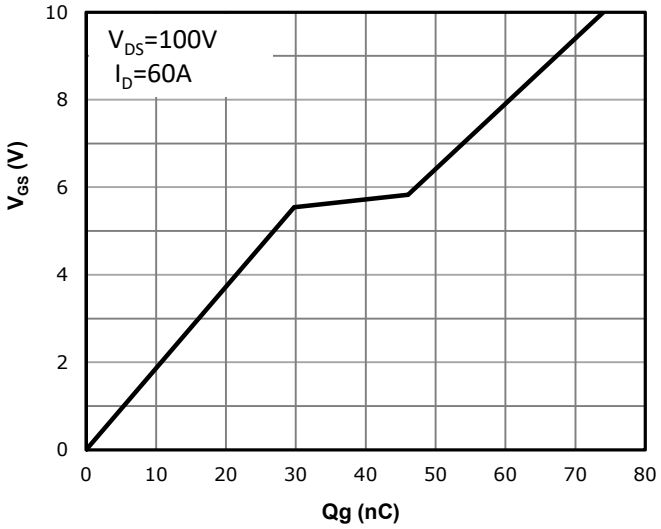



Fig 8: Body-diode Forward Characteristics

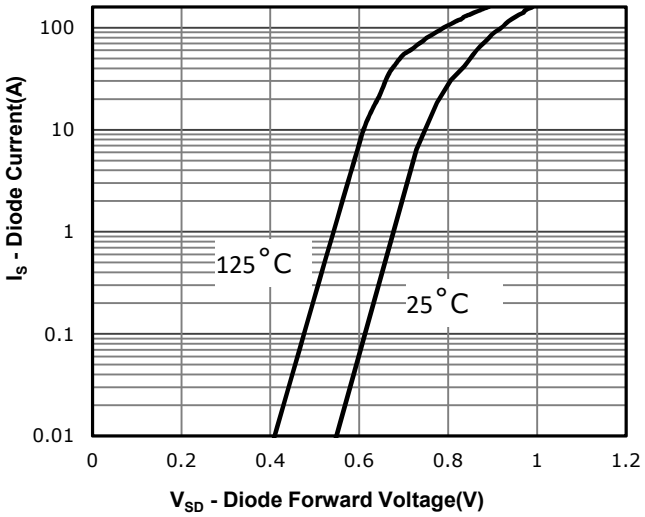



Fig 9: Power Dissipation

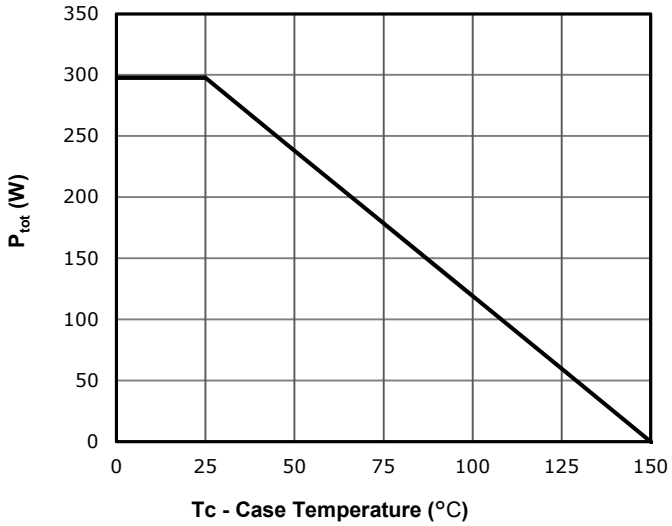



Fig 10: Drain Current Derating

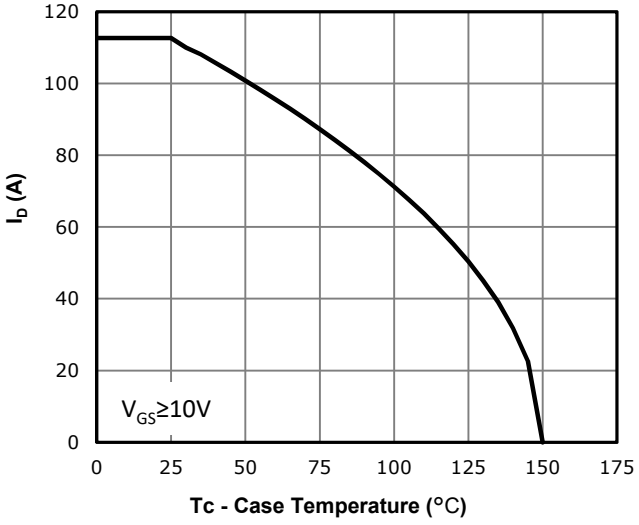
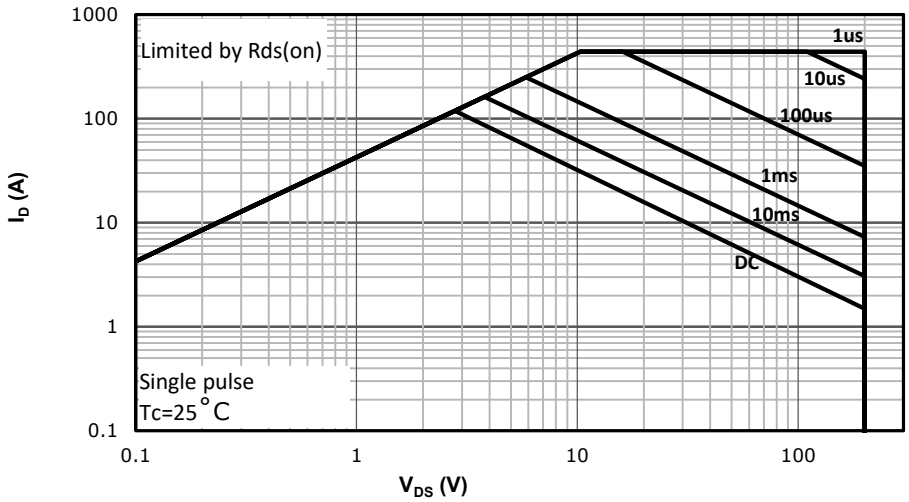


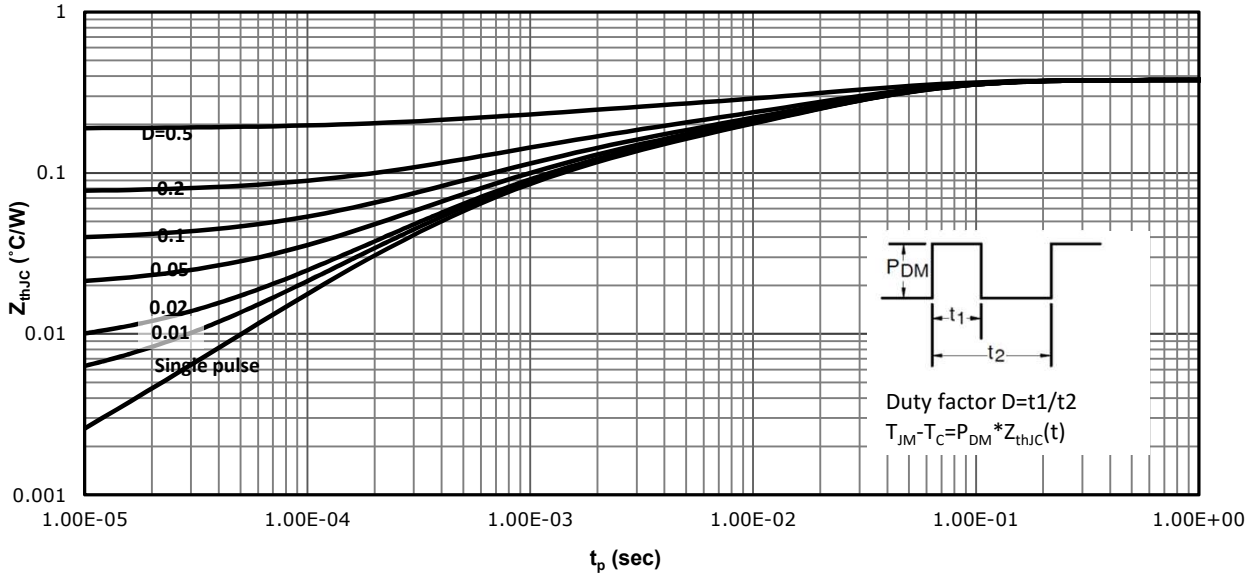

Fig 11: Safe Operating Area





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Fig 12: Max. Transient Thermal Impedance

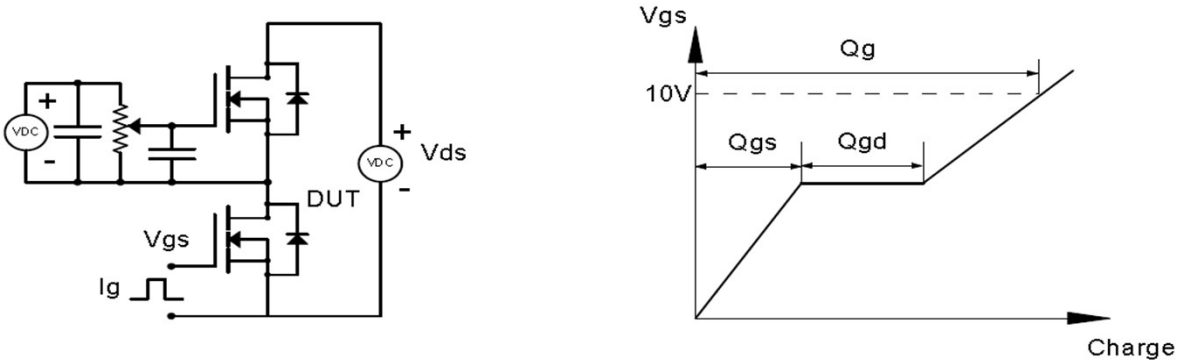




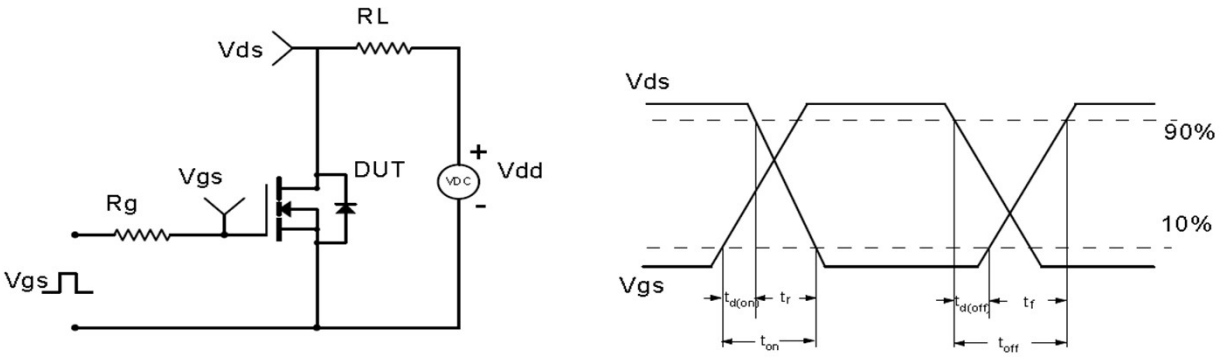
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## Test Circuit & Waveform

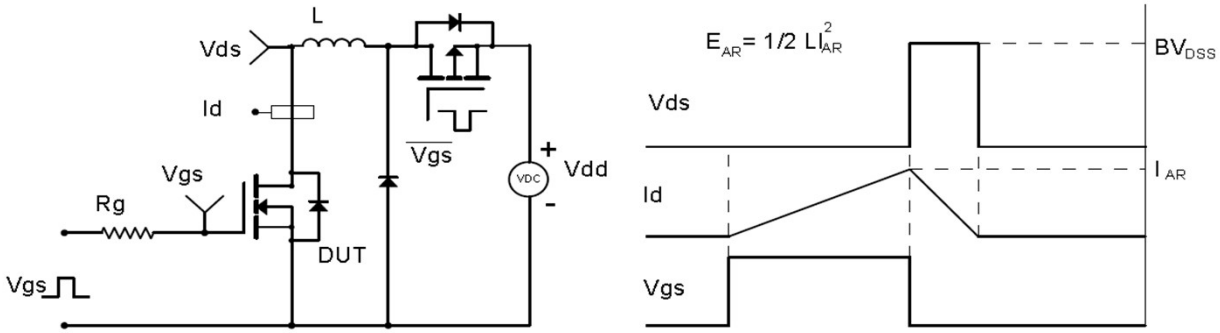
Gate Charge Test Circuit & Waveform



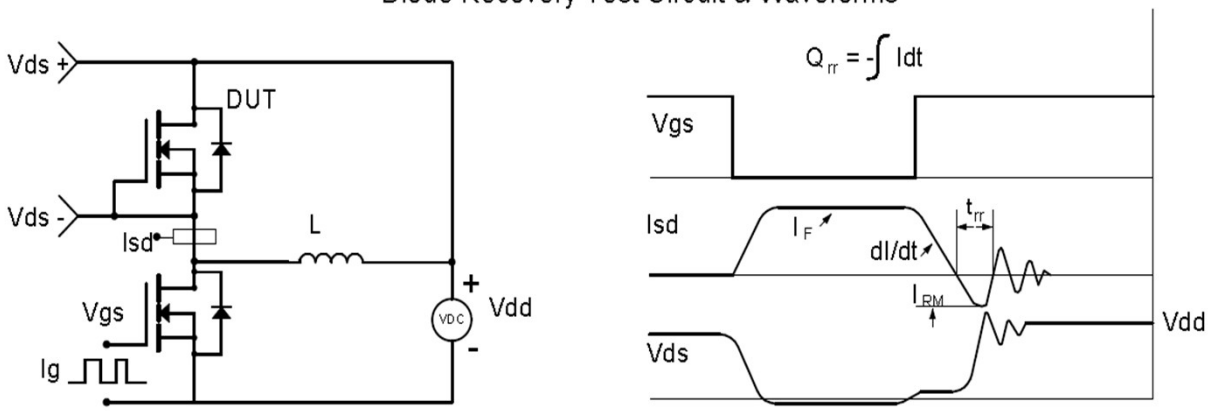

Resistive Switching Test Circuit & Waveforms




Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



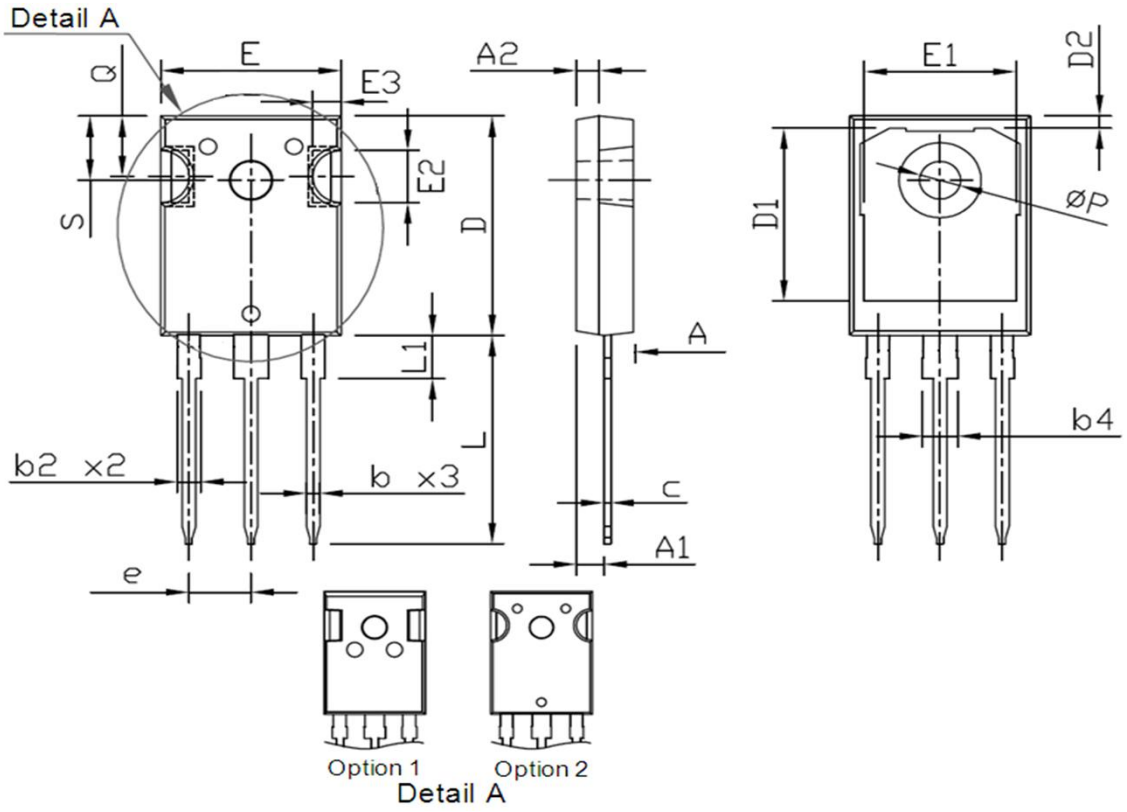

Diode Recovery Test Circuit & Waveforms





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Package Outline: TO-247




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 4.70 | 5.30 | 0.185 | 0.209 |
| A1 | 2.20 | 2.60 | 0.087 | 0.102 |
| A2 | 1.50 | 2.49 | 0.059 | 0.098 |
| b | 1.04 | 1.33 | 0.041 | 0.052 |
| b2 | 1.90 | 2.41 | 0.075 | 0.095 |
| b4 | 2.87 | 3.43 | 0.113 | 0.135 |
| c | 0.55 | 0.70 | 0.022 | 0.028 |
| D | 20.70 | 21.30 | 0.815 | 0.839 |
| D1 | 16.25 | 17.65 | 0.640 | 0.695 |
| D2 | 0.51 | 1.40 | 0.020 | 0.055 |
| e | 5.44 BSC. | | 0.214 BSC. | |
| E | 15.50 | 16.30 | 0.610 | 0.642 |
| E1 | 13.08 | 14.16 | 0.515 | 0.557 |
| E2 | 3.80 | 5.49 | 0.150 | 0.216 |
| E3 | 1.00 | 2.75 | 0.039 | 0.108 |
| L | 19.72 | 20.32 | 0.776 | 0.800 |
| L1 | 3.85 | 4.50 | 0.152 | 0.177 |
| Q | 5.25 | 6.25 | 0.207 | 0.246 |
| P | 3.50 | 3.70 | 0.138 | 0.146 |
| S | 6.04 | 6.30 | 0.238 | 0.248 |


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## Revision History

| Revison | Date | Major changes |
|---|---|---|
| 1.0 | 2022/2/23 | Release of Prelimnary version. |
| 2.0 | 2023/5/16 | modify package limit&Rthjc& IDSS Tj |

## Disclaimer

Unless otherwise specified in the datasheet, the product is designed and qulified as a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability, such as automotive, aviation/aerospace and life-support devices or systems.

Any and all semicondutor products have certain probability to fail or malfunction, which may result in personal injury, death or property damage. Customer are solely responsible for providing adequate safe measures when design their systems.

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