华润微电子(重庆)有限公司

# CRSS022N10N4

SkyMOS4 N-MOSFET 100V, 2.2mΩ, 190A

## Features

- Uses CRM(CQ) advanced SkyMOS4 technology
- Extremely low on-resistance $R_{DS(on)}$
- Excellent $Q_g$x$R_{DS(on)}$ product(FOM)
- Qualified according to JEDEC criteria

## Product Summary

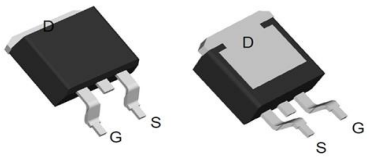
| | |
|---|---|
| $V_{DS}$ | 100V |
| $R_{DS(on).typ}$ | 2.2mΩ |
| $I_D$ | 190A |

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

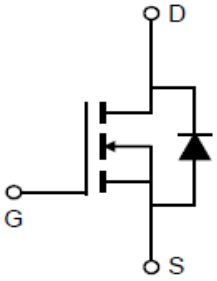
## Applications

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

TO-263




CRSS022N10N4




## Package Marking and Ordering Information

| Part # | Marking | Package | Packing | Reel Size | Tape Width | Qty |
|---|---|---|---|---|---|---|
| CRSS022N10N4 | CRSS022N10N4 | TO-263 | Tape | N/A | N/A | 1000pcs |

## Absolute Maximum Ratings

| **Parameter** | **Symbol** | **Value** | **Unit** |
|---|---|---|---|
| Drain-source voltage | $V_{DS}$ | 100 | 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>280<br>190<br>175 | A |
| Pulsed drain current ($T_C$ = 25°C, $t_p$ limited by $T_{jmax}$) | $I_{D\ pulse}$ | 760 | A |
| Avalanche energy, single pulse ($I_D$ = 87A, Rg=25Ω)[1] | $E_{AS}$ | 1498 | mJ |
| Gate-Source voltage | $V_{GS}$ | ±20 | V |
| Power dissipation ($T_C$ = 25°C) | $P_{tot}$ | 343 | W |
| Operating junction and storage temperature | $T_j$ , $T_{stg}$ | -55...+150 | °C |
| Soldering temperature, wave soldering only allowed at leads (1.6mm from case for 10s) | Tsold | 245 | °C |

※. Notes:
1.EAS is tested at starting Tj = 25℃, L = 0.5mH, IAS =77A, VGS = 10V.
2.Repetitive rating, pulse width limited by junction temperature TJ(MAX)=150°C. Ratings are based on low frequency and duty cycles to keep initial TJ =25°C.


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## Thermal Resistance

| Parameter | Symbol | Max | Unit |
|---|---|---|---|
| Thermal resistance, junction – case. | $R_{thJC}$ | 0.36 | °C/W |
| Thermal resistance, junction – ambient(min. footprint) | $R_{thJA}$ | 63 | |

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

| Parameter | Symbol | Value | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | min. | typ. | max. | | |
| **Static Characteristic** | | | | | | |
| Drain-source breakdown voltage | $BV_{DSS}$ | 100 | - | - | V | $V_{GS}$=0V, $I_D$=250μA |
| Gate threshold voltage | $V_{GS(th)}$ | 2.0 | 3.0 | 4.0 | V | $V_{DS}$=$V_{GS}$,$I_D$=250μA |
| Zero gate voltage drain current | $I_{DSS}$ | -<br>- | -<br>- | 1<br>100 | μA | $V_{DS}$=100V,$V_{GS}$=0V<br>$T_j$=25°C<br>$T_j$=125°C |
| Gate-source leakage current | $I_{GSS}$ | 0 | - | ±100 | nA | $V_{GS}$=±20V,$V_{DS}$=0V |
| Drain-source on-state resistance | | -<br>- | 2.0<br>2.2 | 2.6<br>2.9 | | VGS=10V, ID=90A<br>VGS=8V, ID=90A |
| Transconductance | $g_{fs}$ | - | 287.4 | - | S | $V_{DS}$=5V, $I_D$=90A |
| **Dynamic Characteristic** | | | | | | |
| Input Capacitance | $C_{iss}$ | - | 11371 | 17056.5 | pF | $V_{GS}$=0V, $V_{DS}$=50V, f=1MHz |
| Output Capacitance | $C_{oss}$ | - | 1612 | 2418 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | - | 25 | 50 | | |
| Gate Total Charge | $Q_G$ | - | 159.1 | 238.65 | nC | $V_{GS}$=10V, $V_{DS}$=50V, $I_D$=90A |
| Gate-Source charge | $Q_{gs}$ | - | 64.4 | 96.6 | | |
| Gate-Drain charge | $Q_{gd}$ | - | 18.5 | 37.0 | | |
| Turn-on delay time | $t_{d(on)}$ | - | 34.1 | 68.2 | ns | $V_{GS}$=10V, $V_{DD}$=50V, $R_{G_ext}$=2.7Ω |
| Rise time | $t_r$ | - | 128.6 | 192.9 | | |
| Turn-off delay time | $t_{d(off)}$ | - | 89.5 | 134.3 | | |
| Fall time | $t_f$ | - | 45.1 | 67.65 | | |
| Gate resistance | $R_G$ | - | 1.8 | 9 | Ω | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz |


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## Body Diode Characteristic

| Parameter | Symbol | Value | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | min. | typ. | max. | | |
| Body Diode Forward Voltage | $V_{SD}$ | - | 0.9 | 1.4 | V | $V_{GS}$=0V,$I_{SD}$=90A |
| Body Diode Reverse Recovery Time | $t_{rr}$ | - | 103.6 | 207 | ns | $I_F$=90A,dI/dt=100A/μs |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | - | 279.2 | 558 | nC | |


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## Typical Performance Characteristics

Fig 1: Output Characteristics

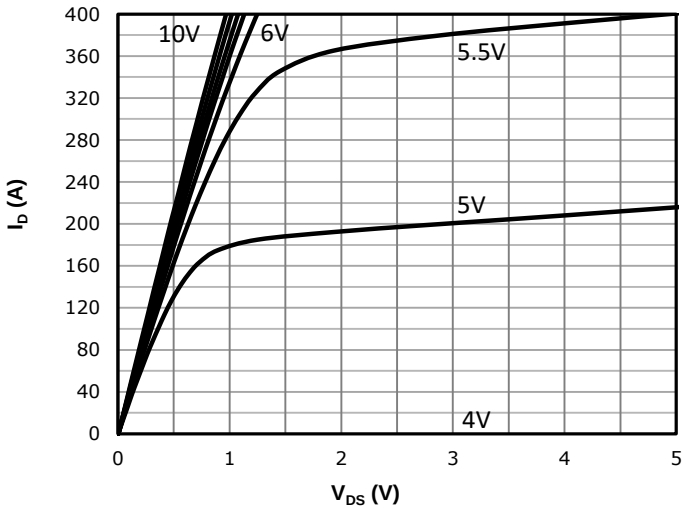



Fig 2: Transfer Characteristics

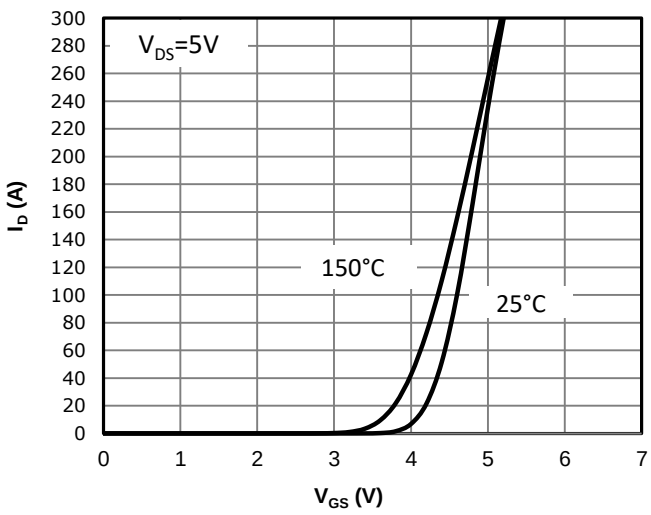



Fig 3: Rds(on) vs Drain Current and Gate Voltage

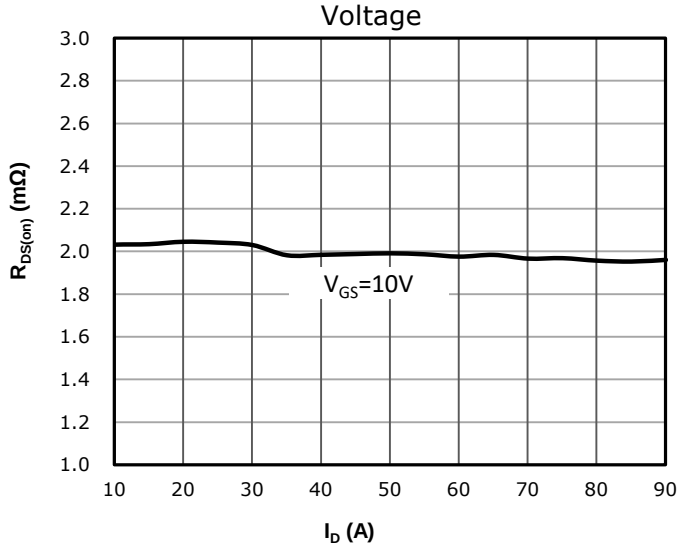



Fig 4: Rds(on) vs Gate Voltage

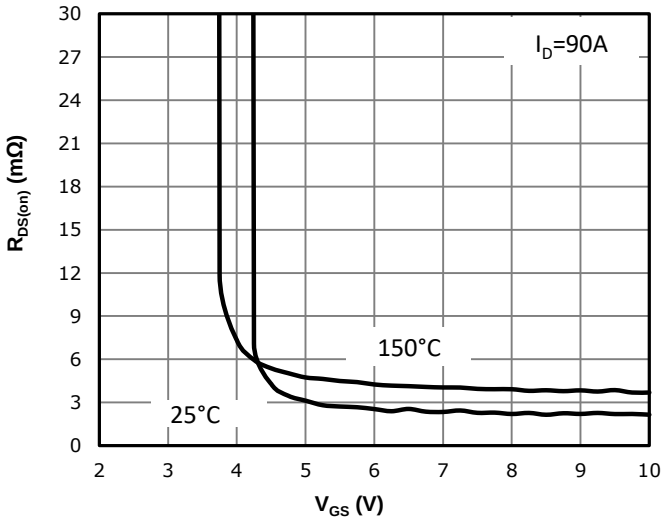



Fig 5: Rds(on) vs. Temperature

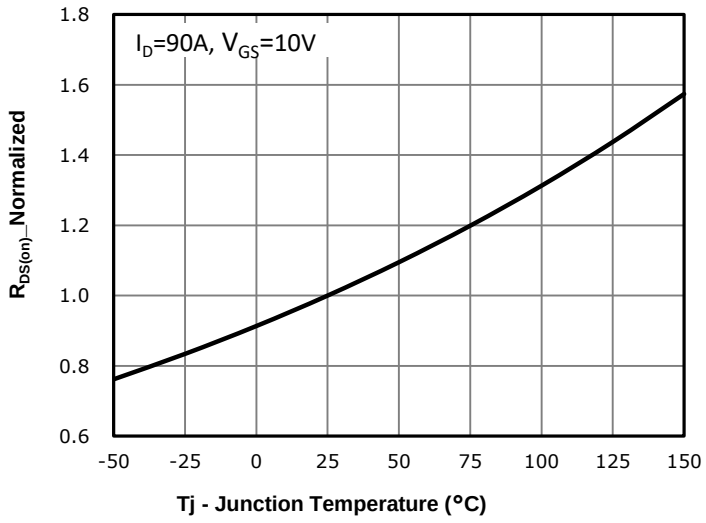
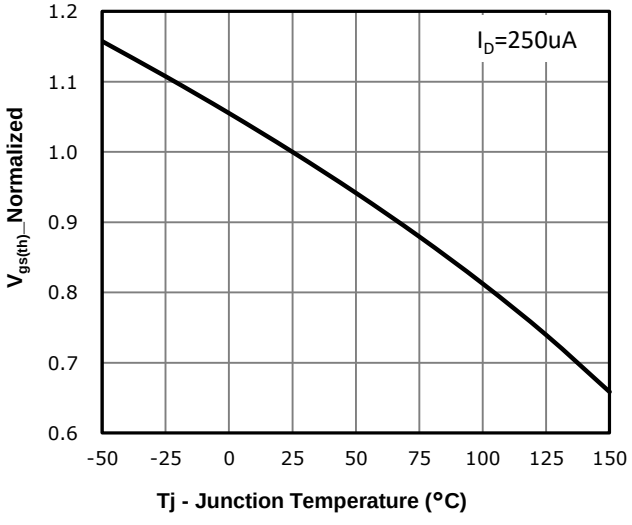



Fig 6: Vgs(th) vs. Temperature





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Fig 7: BVdss vs. Temperature

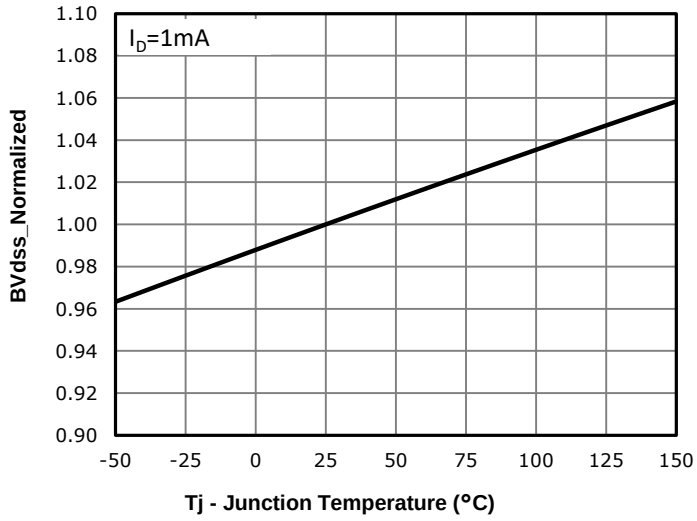



Fig 8: Capacitance Characteristics

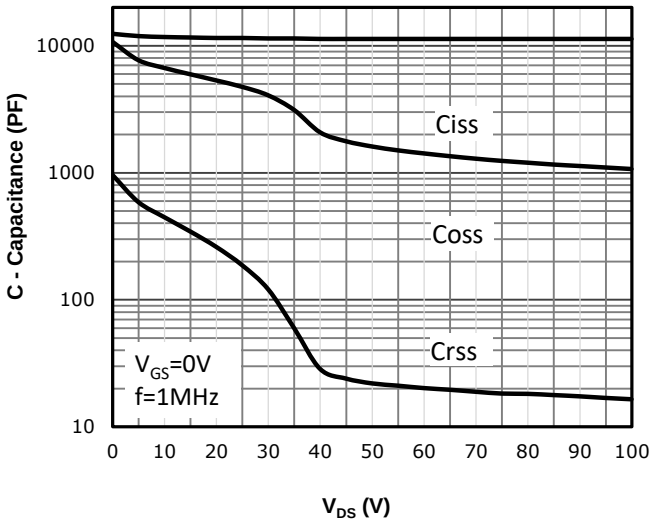



Fig 9: Gate Charge Characteristics

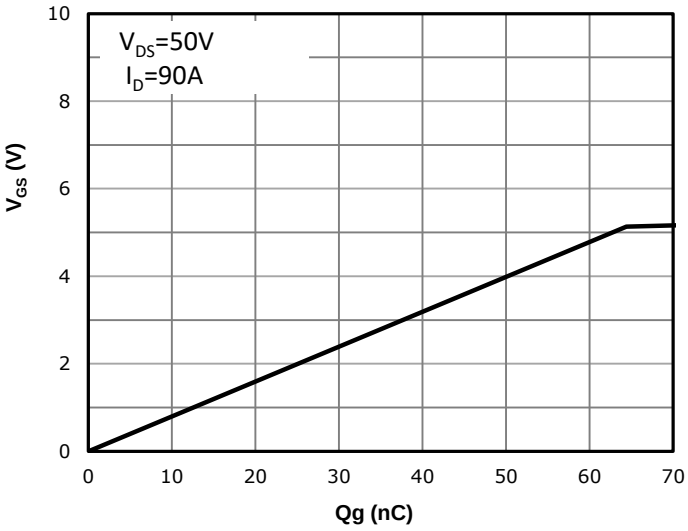



Fig 10: Body-diode Forward Characteristics

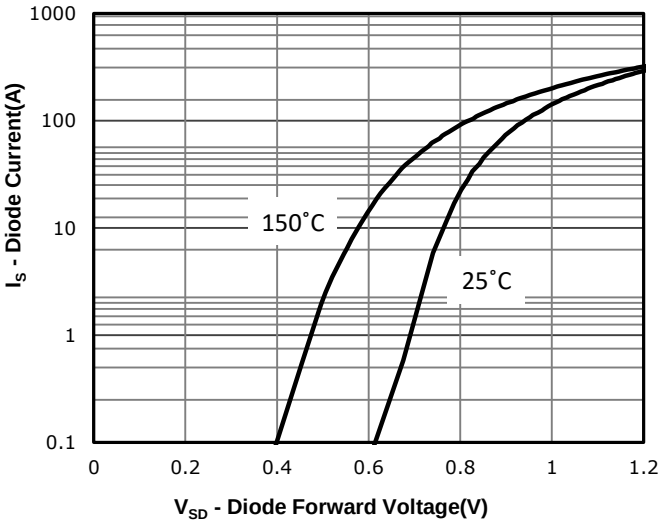



Fig 11: Power Dissipation

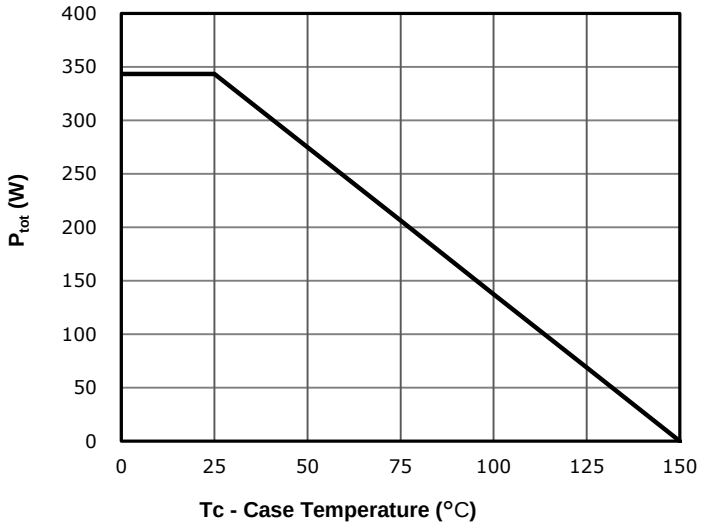
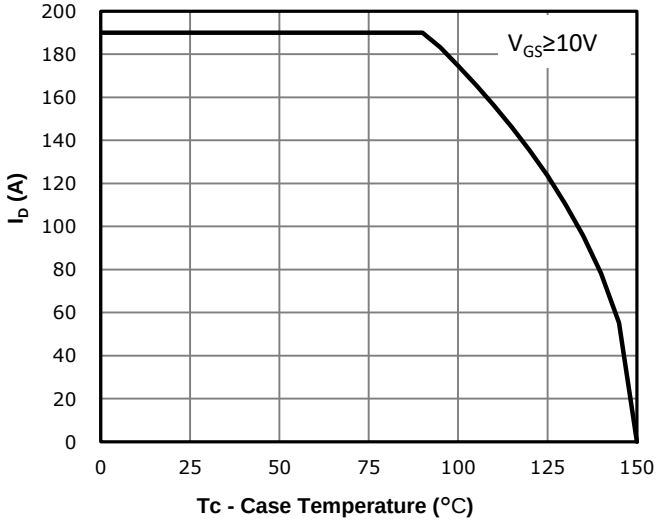



Fig 12: Drain Current Derating





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Fig 13: Safe Operating Area

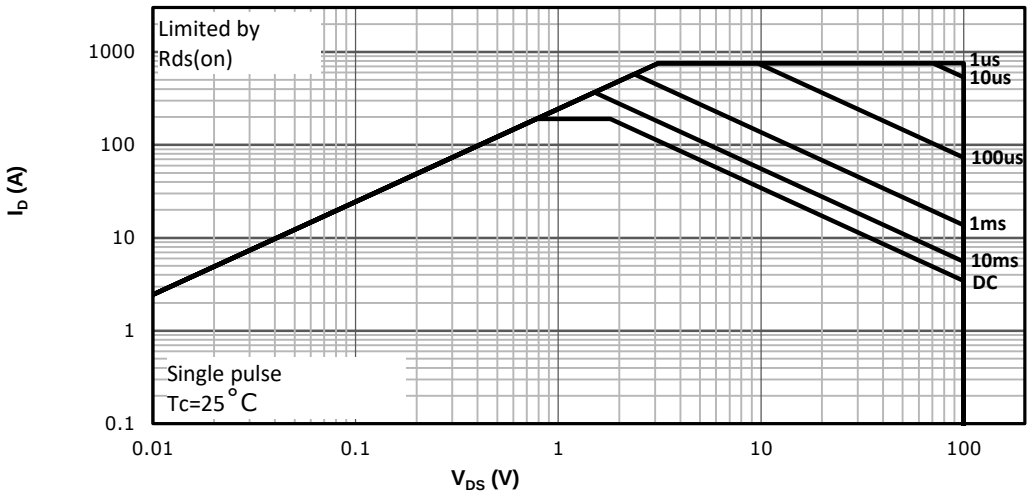
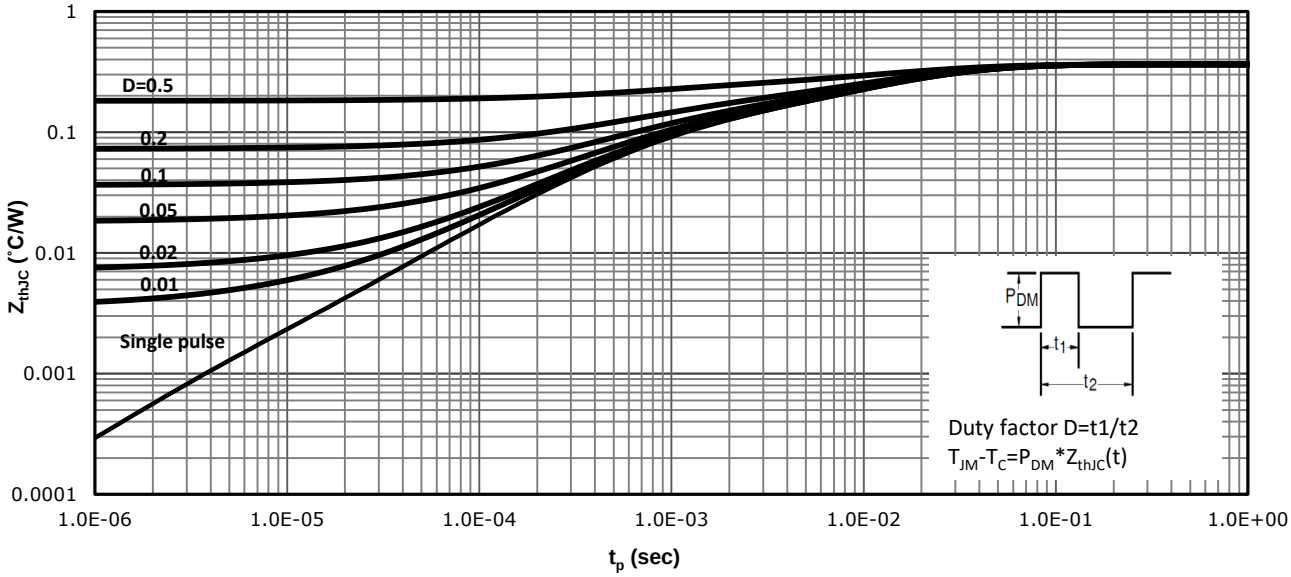



Fig 14: Max. Transient Thermal Impedance

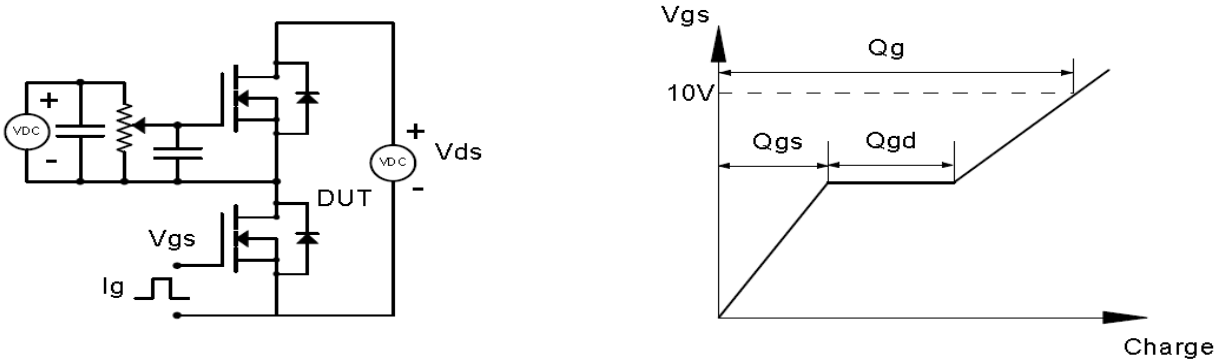




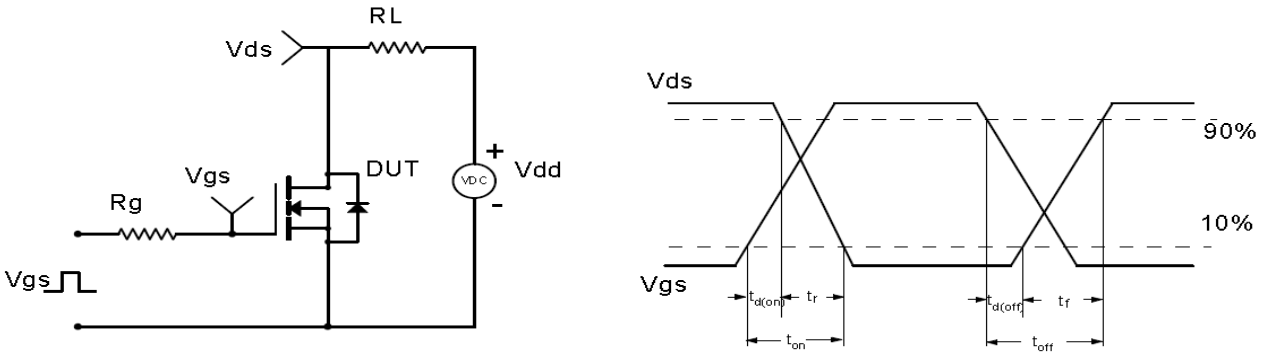
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## Test Circuit & Waveform

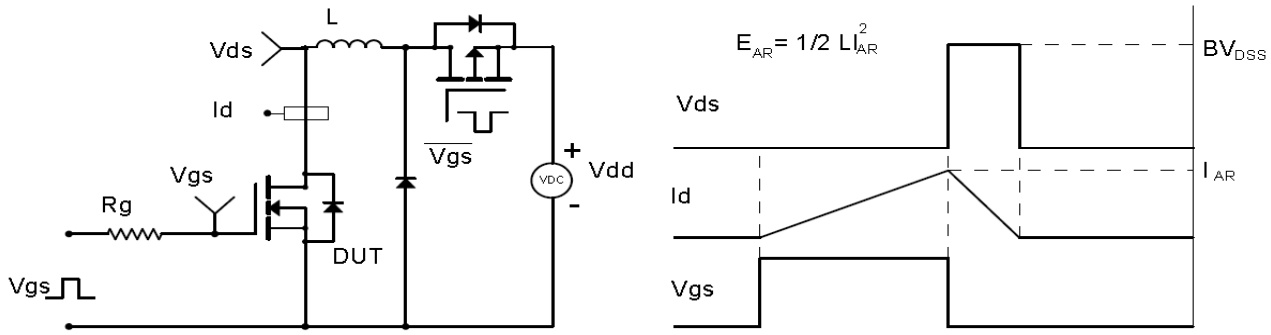
Gate Charge Test Circuit & Waveform



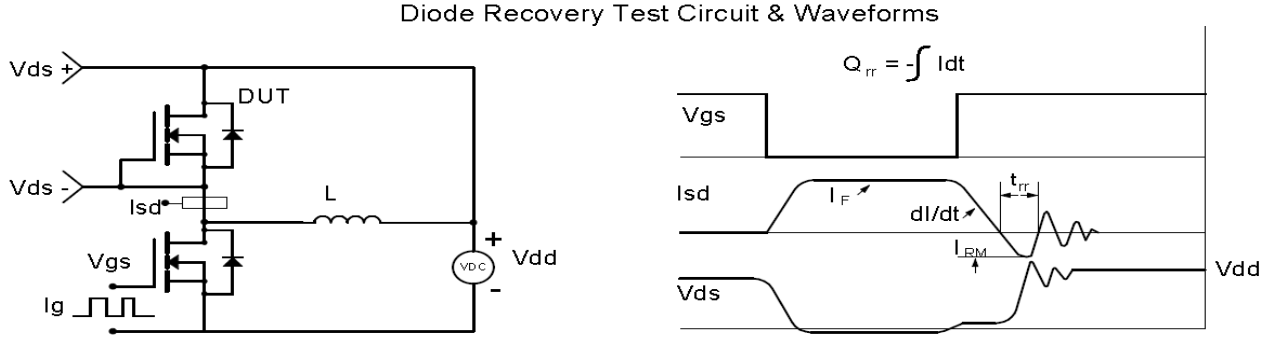

Resistive Switching Test Circuit & Waveforms




Unclamped Inductive Switching (UIS) Test Circuit & Waveforms




Diode Recovery Test Circuit & Waveforms

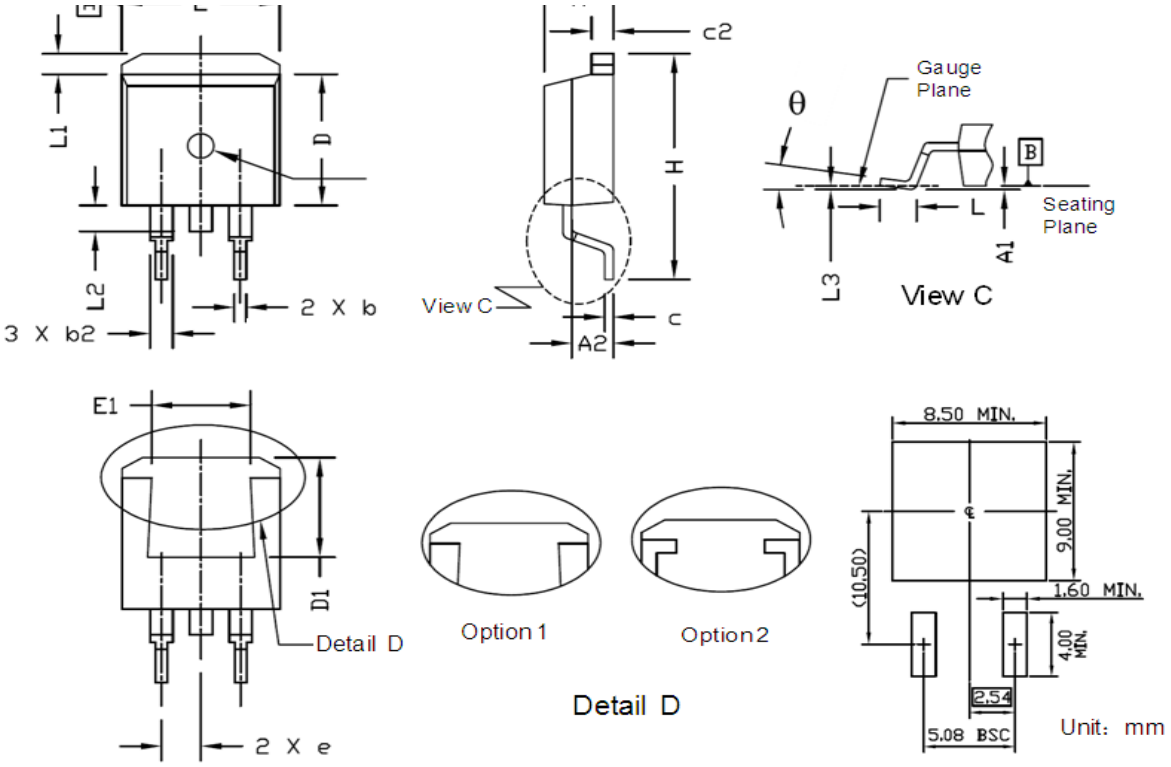



## Package Outline: TO-263





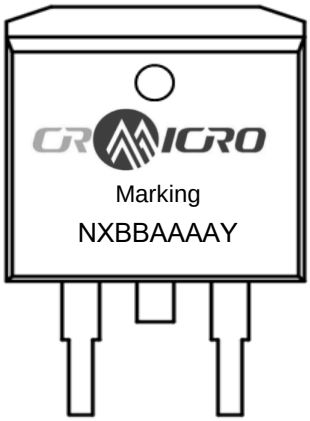
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| Symbol | | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|---|
| | | Min. | Max. | Min. | Max. |
| A | | 4.30 | 4.86 | 0.169 | 0.191 |
| A1 | | 0.00 | 0.25 | 0.000 | 0.010 |
| A2 | | 2.20 | 2.90 | 0.087 | 0.114 |
| b | | 0.68 | 0.94 | 0.027 | 0.037 |
| b2 | | 1.14 | 1.78 | 0.045 | 0.070 |
| c | | 0.33 | 0.65 | 0.013 | 0.026 |
| c2 | | 1.17 | 1.40 | 0.046 | 0.055 |
| D | | 8.38 | 9.45 | 0.330 | 0.372 |
| D1 | | 6.90 | 8.17 | 0.272 | 0.322 |
| e | | 2.54 BSC. | | 0.100 BSC. | |
| E | | 9.78 | 10.50 | 0.385 | 0.413 |
| E1 | | 6.50 | 8.60 | 0.256 | 0.339 |
| H | | 14.61 | 15.88 | 0.575 | 0.625 |
| L | | 1.78 | 2.79 | 0.070 | 0.110 |
| L1 | | 0.70 | 1.60 | 0.028 | 0.063 |
| L2 | | 1.00 | 1.78 | 0.039 | 0.070 |
| L3 | | 0.25 BSC. | | 0.010 BSC. | |
| θ | Option A | -8° | 0° | -8° | 0° |
| | Option B | 0° | 8° | 0° | 8° |


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## Marking




NOTE:
NXBBAAAAY

| | |
|---|---|
| N | —Wire Bond code |
| X | —Assembly location code |
| BB | —Fab code |
| AAAA | —Lot code |
| Y | —Bin code |


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## Revision History

| Revision | Date | Major changes |
|---|---|---|
| 0.1 | 2024/3/27 | Release of  Preliminary version. |
| 0.2 | 2024/3/29 | Update Trr, Qrr, Ron. |

## Disclaimer

Unless otherwise specified in the datasheet, the product is designed and qualified 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.

CRM(CQ) reserves the right to improve product design, function and reliability without notice.


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