# CRTD190P06L2-G

Trench P-MOSFET -60V, 16.3mΩ, -60A

## Features

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

## Applications

- Motor control and drive
- Electrical tools
- Lithium battery protection

## Product Summary

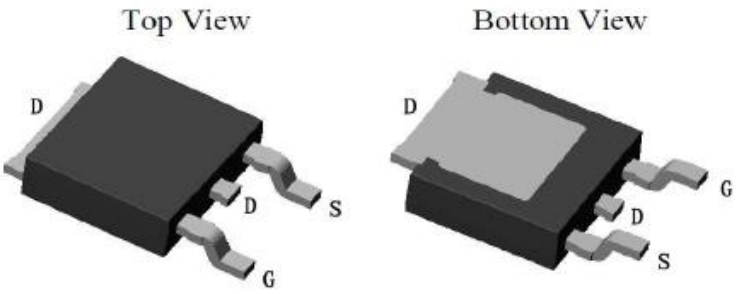
| | |
|---|---|
| $V_{DS}$ | -60V |
| $R_{DS(on)}$ typ. | 16.3mΩ |
| $I_D$ (Silicon limit) | -60A |

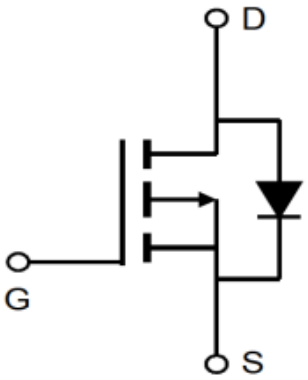
***100% DVDS Tested***

***100% Avalanche Tested***

RoHS HF

**TO-252**




## Package Marking and Ordering Information

| Part # | Marking | Package | Packing | Reel Size | Tape Width | Qty |
|---|---|---|---|---|---|---|
| CRTD190P06L2-G | T190P06L2 | TO-252 | Reel | N/A | N/A | 2500pcs |

## Absolute Maximum Ratings

| **Parameter** | **Symbol** | **Value** | **Unit** |
|---|---|---|---|
| Drain-source voltage | $V_{DS}$ | -60 | V |
| Continuous drain current<br>$T_C$ = 25°C (Silicon limit)[a1]<br>$T_C$ = 25°C (Package limit)[a1]<br>$T_C$ = 100°C (Silicon limit) | $I_D$ | <br>-60<br>-60<br>-39 | A |
| Pulsed drain current ($T_C$ = 25°C, $t_p$ limited by $T_{jmax}$) | $I_{D\ pulse}$ | -240 | A |
| Avalanche energy, single pulse (L=0.5mH) | $E_{AS}$ | 256 | mJ |
| Gate-Source voltage | $V_{GS}$ | ±20 | V |
| Power dissipation ($T_C$ = 25°C) | $P_{tot}$ | 119 | 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) | $T_{sold}$ | 260 | °C |


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## Thermal Resistance

| Parameter | Symbol | Typ | Max | Unit |
|---|---|---|---|---|
| Thermal resistance, junction – case. | $R_{thJC}$ | - | 1.05 | °C/W |
| Thermal resistance, junction – ambient(min. footprint) | $R_{thJA}$[a2] | - | 62.5 | |

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

| Parameter | Symbol | Value | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | min. | typ. | max. | | |
| **Static Characteristic** | | | | | | |
| Drain-source breakdown voltage | $BV_{DSS}$ | -60 | - | - | V | $V_{GS}$=0V, $I_D$=-250uA |
| Gate threshold voltage | $V_{GS(th)}$ | -1 | -1.5 | -2 | V | $V_{DS}$=$V_{GS}$, $I_D$=-250uA |
| Zero gate voltage drain current | $I_{DSS}$ | - | - | -1 | μA | $V_{DS}$=-60V, $V_{GS}$=0V<br>$T_j$=25°C |
| | | - | - | -100 | | $T_j$=150°C |
| Gate-source leakage current | $I_{GSS}$ | - | - | ±100 | nA | $V_{GS}$=±20V,$V_{DS}$=0V |
| Drain-source on-state resistance | $R_{DS(on)}$ | - | 16.3 | 20 | mΩ | $T_j$=25°C<br>$V_{GS}$=-10V, $I_D$=-19A |
| | | - | 18 | 22.5 | | $V_{GS}$=-4.5V, $I_D$=-19A |
| Transconductance | $g_{fs}$ | | 30.3 | | S | $V_{DS}$=-5V, $I_D$=-19A |
| **Dynamic Characteristic** | | | | | | |
| Input Capacitance | $C_{iss}$ | - | 5263 | - | pF | VGS=0V, VDS=-30V<br>f=1MHz |
| Output Capacitance | $C_{oss}$ | - | 218 | - | | |
| Reverse Transfer Capacitance | $C_{rss}$ | - | 164 | - | | |
| Gate Total Charge | $Q_g$ | - | 92.48 | - | nC | VGS=-10V, VDS=-30V<br>ID=-19A |
| Gate-Source charge | $Q_{gs}$ | - | 12.67 | - | | |
| Gate-Drain charge | $Q_{gd}$ | - | 15.05 | - | | |
| Turn-on delay time | $t_{d(on)}$ | - | 16 | - | ns | $V_{GS}$=-10V,<br>VDS=-30V<br>RG=3.0Ω,<br>ID=-19A |
| Rise time | $t_r$ | - | 6.3 | - | | |
| Turn-off delay time | $t_{d(off)}$ | - | 224 | - | | |
| Fall time | $t_f$ | - | 68.6 | - | | |
| Gate resistance | $R_G$ | - | 7 | - | 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 | $V_{SD}$ | - | - | -1.2 | V | $V_{GS}$=0V, $I_{SD}$=-19A |
| Body Diode Continuous Forward Current | $I_S$ | - | - | -60 | A | $T_C$ = 25°C |
| Body Diode Reverse Recovery Time | $t_{rr}$ | - | 23.79 | - | ns | $I_F$=-19A, dI/dt=100A/μs |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | - | 19.59 | - | nC | |

a1：Calculated continuous current based on maximum allowable junction temperature. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements.
a2：The value of $R_{thJA}$ is measured by placing the device in a still air box which is one cubic foot.


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## Typical Performance Characteristics

Fig 1: Output Characteristics

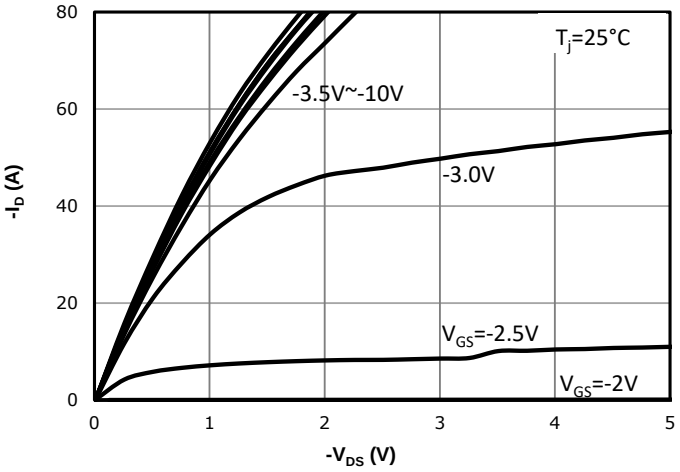



Fig 2: Transfer Characteristics

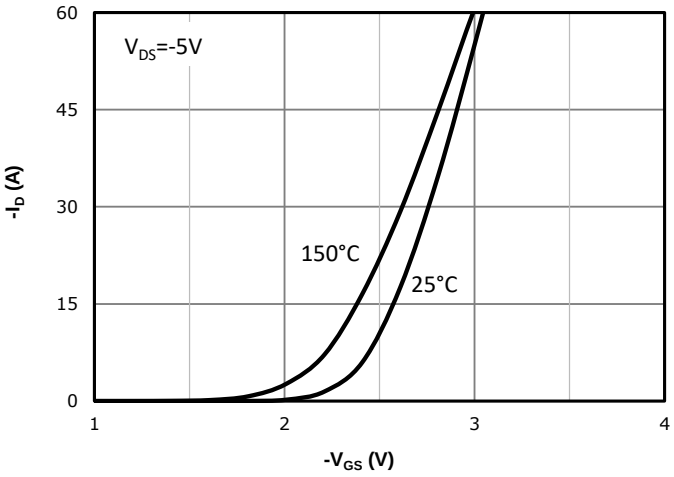



Fig 3: Rds(on) vs Drain Current and Gate Voltage

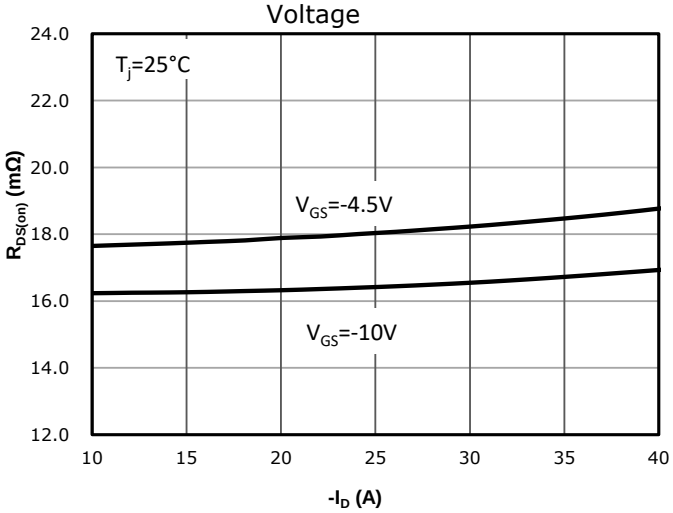



Fig 4: Rds(on) vs Gate Voltage

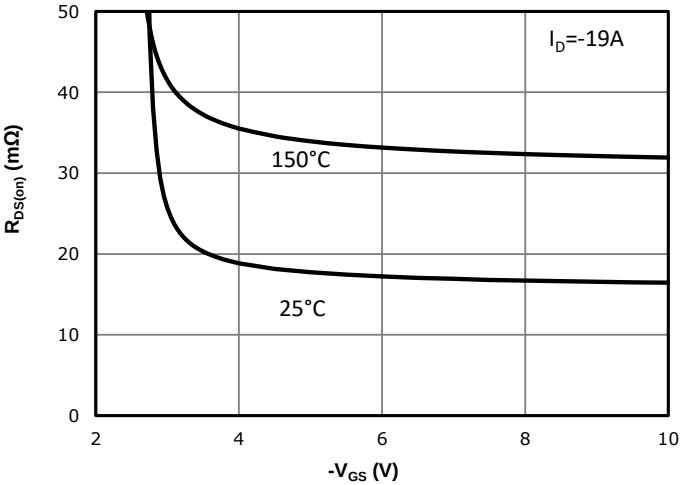



Fig 5: Rds(on) vs. Temperature

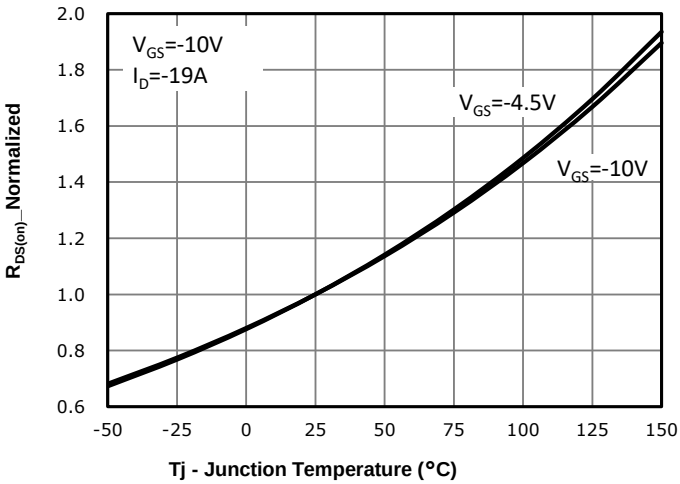
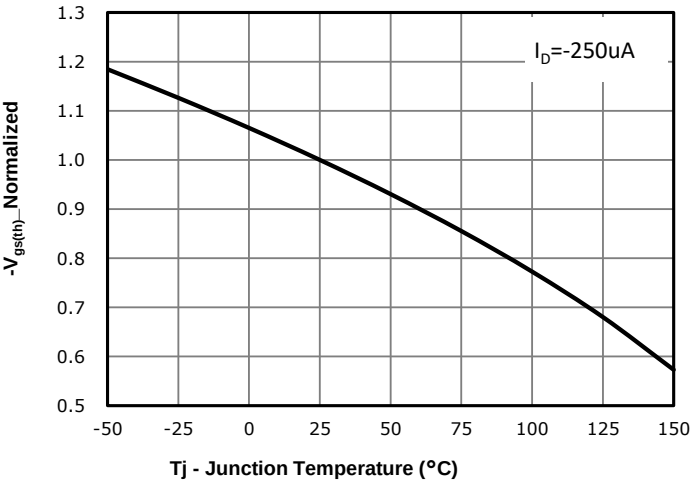



Fig 6: Vgs(th) vs. Temperature





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Fig 7: BVdss vs. Temperature

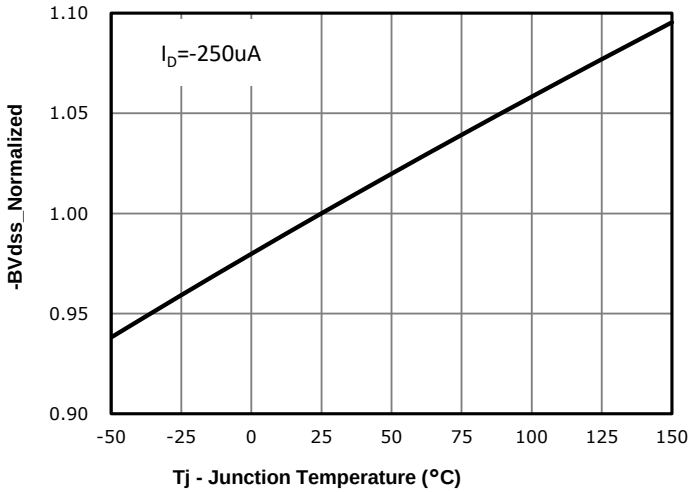



Fig 8: Body-diode Forward Characteristics

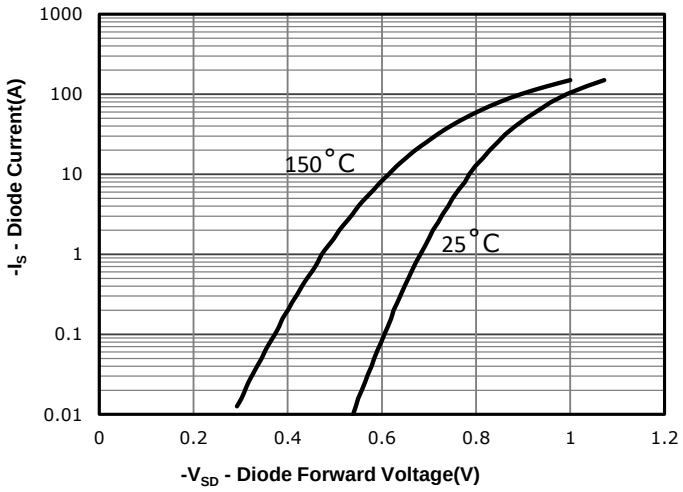



Fig 9: Gate Charge Characteristics

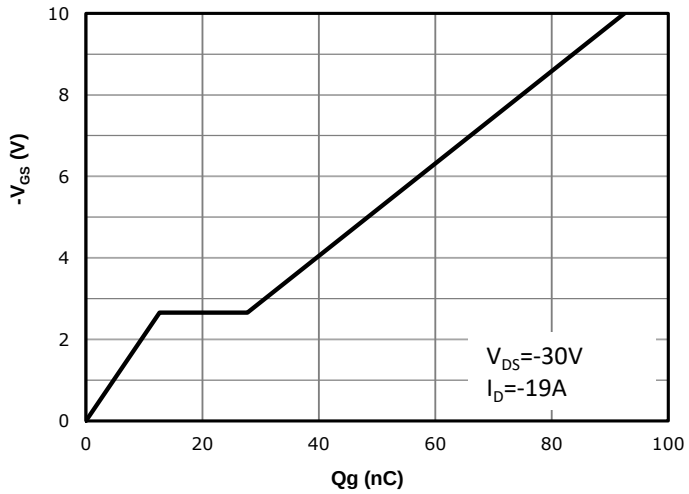



Fig 10: Capacitance Characteristics

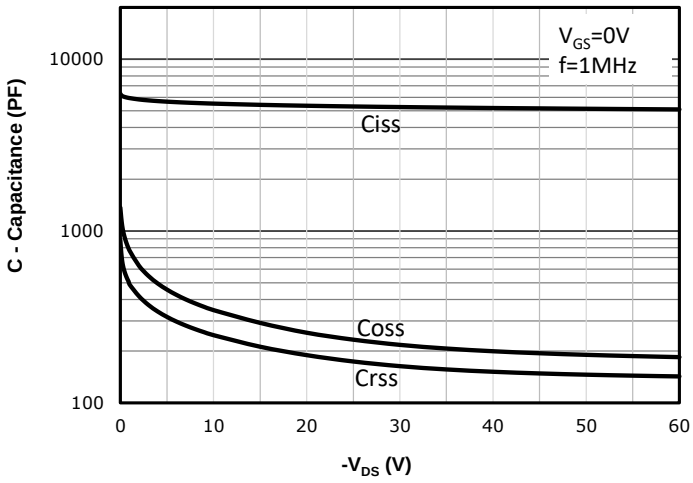



Fig 11: Drain Current Derating

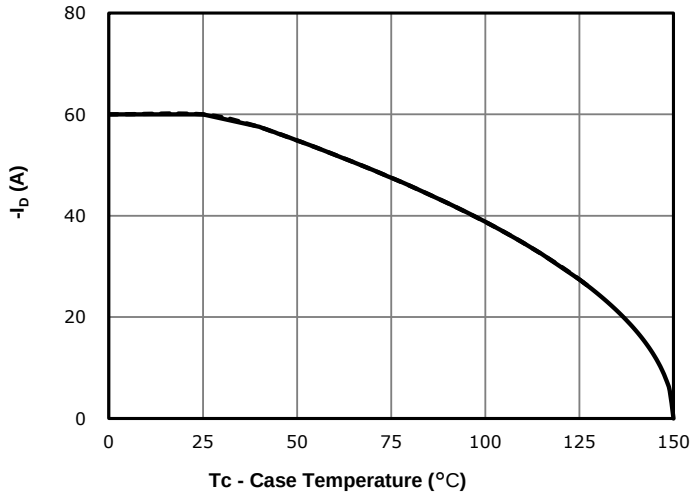
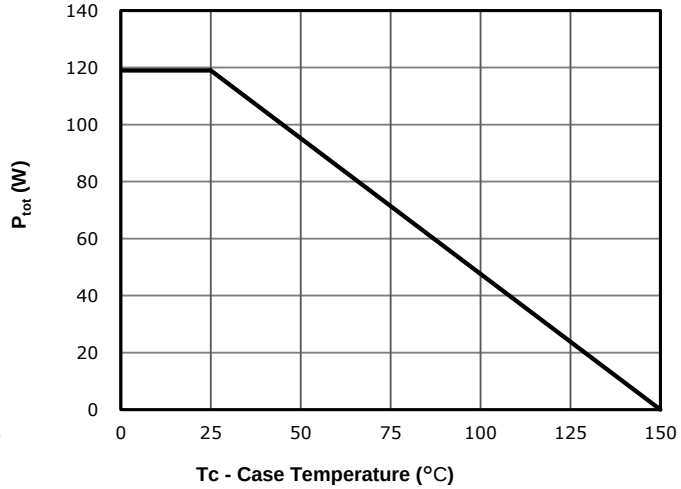



Fig 12: Power Dissipation





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Fig 13: Safe Operating Area

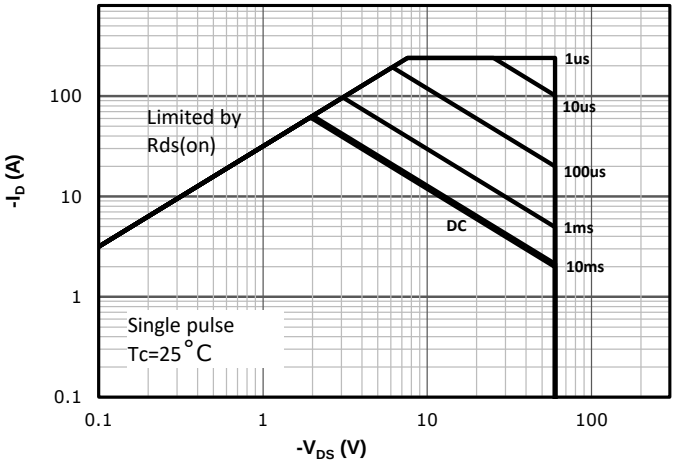
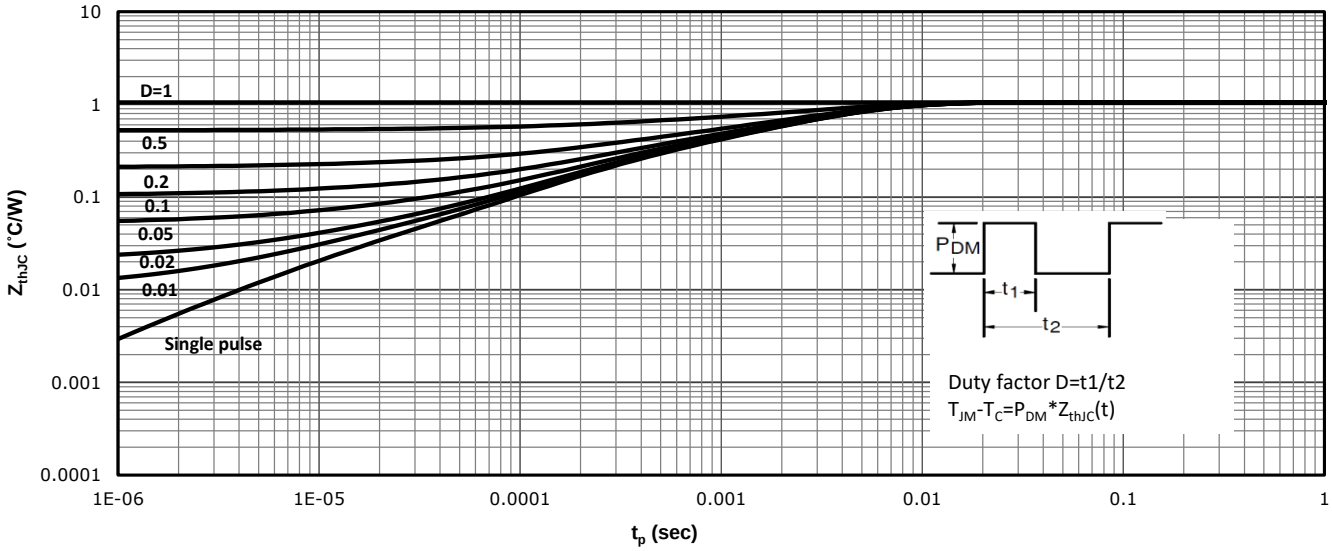



Fig 14: Max. Transient Thermal Impedance

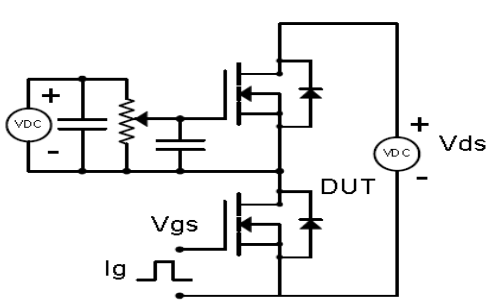


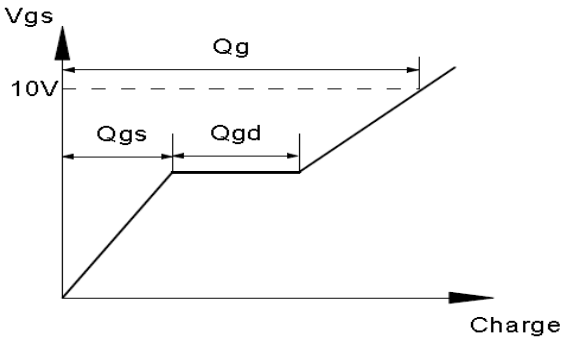


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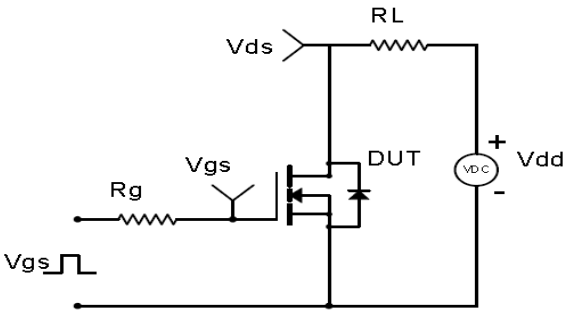
## Test Circuit & Waveform

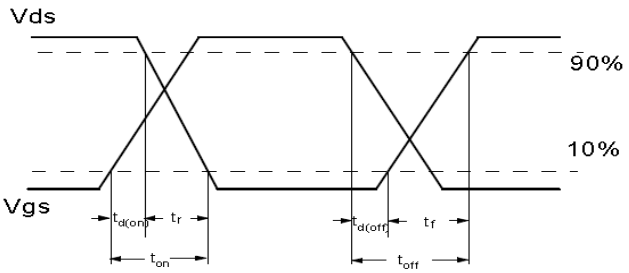
Gate Charge Test Circuit & Waveform



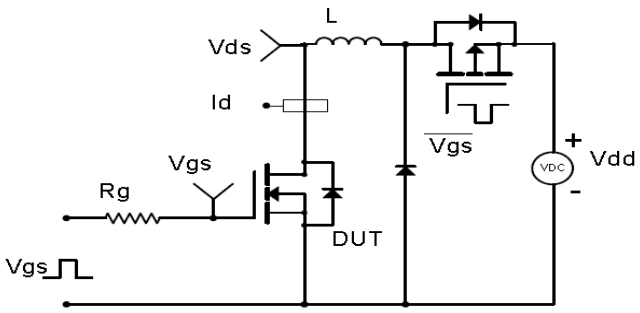



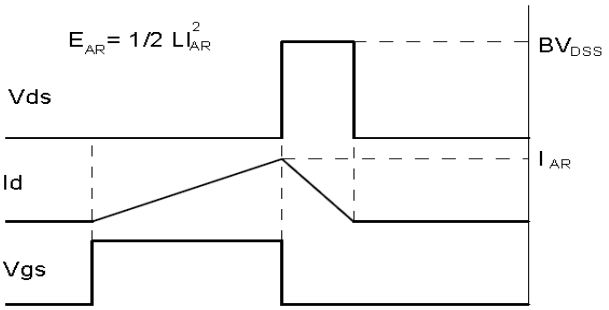

Resistive Switching Test Circuit & Waveforms



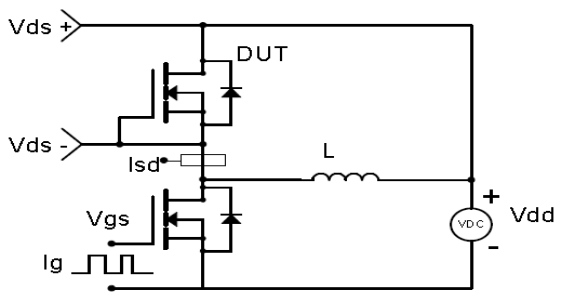



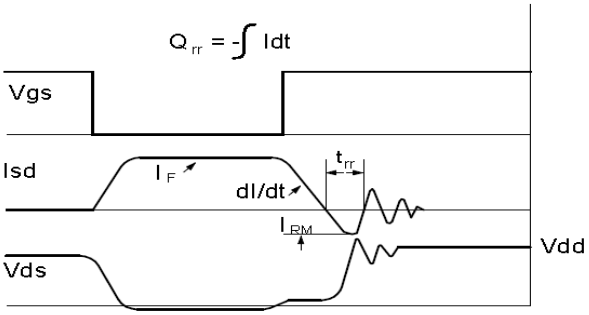

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms




Diode Recovery Test Circuit & Waveforms

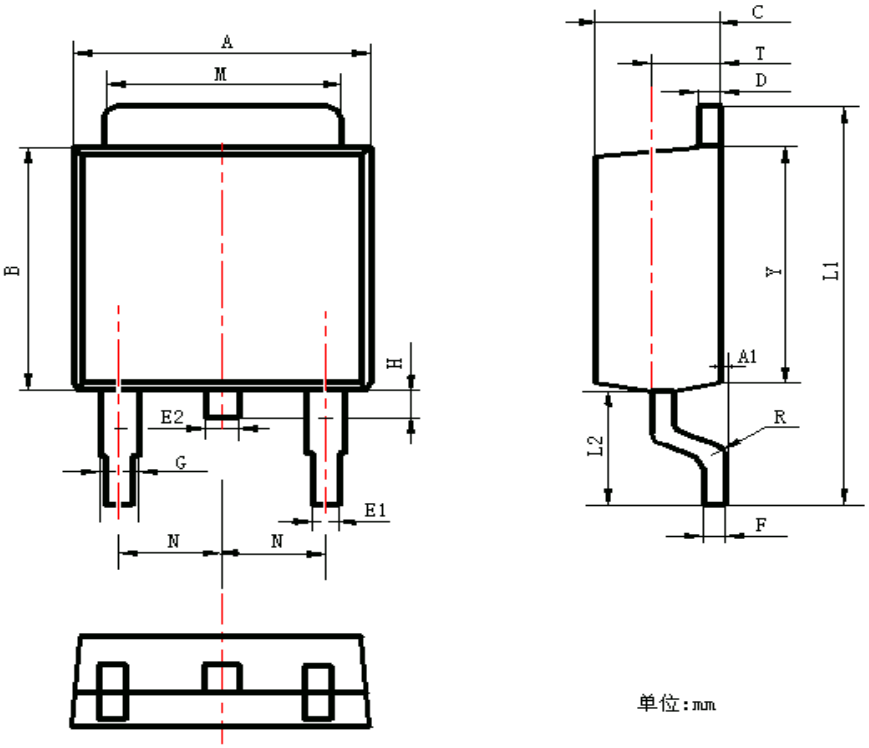




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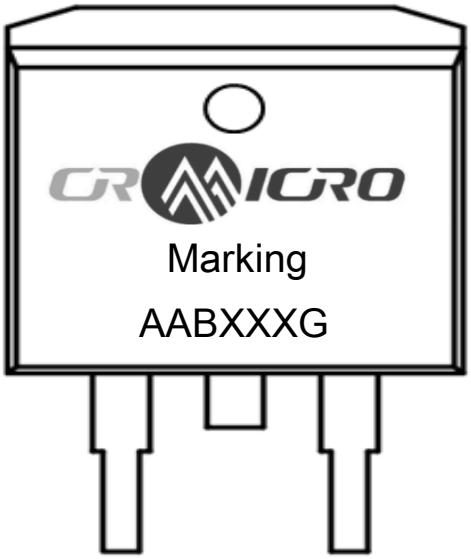
## Package Outline: TO-252




| Symbol | Values(mm) | |
|---|---|---|
| | Min. | Max. |
| A | 6.3 | 6.9 |
| A1 | 0.0 | 0.2 |
| B | 5.7 | 6.3 |
| C | 2.1 | 2.5 |
| D | 0.3 | 0.7 |
| E1 | 0.6 | 0.9 |
| E2 | 0.7 | 1.0 |
| F | 0.3 | 0.6 |
| G | 0.7 | 1.2 |
| L1 | 9.6 | 10.5 |
| L2 | 2.7 | 3.1 |
| H | 0.4 | 1.0 |
| M | 5.1 | 5.5 |
| N | 2.1 | 2.5 |
| R | 0.3 | |
| T | 1.4 | 1.6 |
| Y | 5.1 | 6.3 |


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**Marking**




NOTE:
AABXXXG
AA —cycle code
B —Fab code
XXX —Assembly lot code


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## Revision History

| Revison | Date | Major changes |
|---|---|---|
| 1.0 | 2023/3/7 | Initial Release |
| 2.0 | 2023/5/18 | Modified electrical symbol |
| 3.0 | | |

## 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.

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


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