## 650V Super Junction Power MOSFET

- ★ Super_Junction technology
- ★ Much lower Ron*A performance for On-state efficiency
- ★ Better efficiency due to very low FOM
- ★ Qualified for industrial grade applications according to JEDEC

### Product Summary

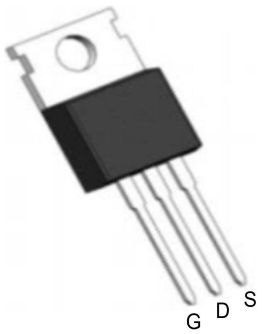
Green

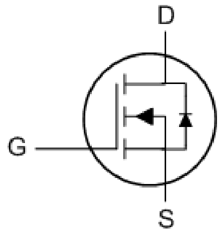
| BVDSS | RDSON | ID |
|---|---|---|
| 650V | 0.11 Ω | 24A |

## Description

The XR65R110T use super junction technology and design to provide excellent RDS(ON) with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.
The XR65R110T meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

### TO220AB Pin Configuration




### Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 650 | V |
| $V_{GS}$ | Gate-Source Voltage | ±30 | V |
| $I_D$@$T_C$=25˚C | Continuous Drain Current, $V_{GS}$ @ 10V[1,6] | 24 | A |
| $I_D$@$T_C$=100˚C | Continuous Drain Current, $V_{GS}$ @ 10V[1,6] | 12 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 96 | A |
| EAS | Single Pulse Avalanche Energy[3] | 300 | mJ |
| $I_{AS}$ | Avalanche Current | --- | A |
| $P_D$@$T_C$=25˚C | Total Power Dissipation[4] | 89 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | ˚C |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | ˚C |

### Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient [1] | --- | 67 | ˚C/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case[1] | --- | 1.4 | ˚C/W |

## Electrical Characteristics ($T_J$=25 ℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250uA | 650 | --- | --- | V |
| △$BV_{DSS}$/△$T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=1mA | --- | --- | --- | V/℃ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V , $I_D$=16A | --- | 0.11 | 0.14 | T |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 3.2 | --- | 4.6 | V |
| △$V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | --- | --- | mV/℃ |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=650V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 5 | uA |
| | | $V_{DS}$=650V, $V_{GS}$=0V , $T_J$=150℃ | --- | 220 | --- | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±30V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=20V , $I_D$=16A | --- | 16.5 | --- | S |
| $R_g$ | Gate Resistance | $V_{DS}$=0V , $V_{GS}$=0V , f=1MHz | --- | 10 | --- | Ω |
| $Q_g$ | Total Gate Charge | $V_{DS}$=480V , $V_{GS}$=10V , $I_D$=16A | --- | 46 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 14 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 24 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | VGS=10V, VDD=400V, RG=27Ω, ID=16A | --- | 60 | --- | ns |
| $T_r$ | Rise Time | | --- | 61 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 140 | --- | |
| $T_f$ | Fall Time | | --- | 31 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=100V , $V_{GS}$=0V , f=1MHz | --- | 1595 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 90 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 1.5 | --- | |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current[1,4] | $V_G$=$V_D$=0V , Force Current | --- | --- | 24 | A |
| $V_{SD}$ | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=16A , $T_J$=25C | 0.7 | 0.86 | 1.1 | V |
| $t_{rr}$ | Reverse Recovery Time | IF=16 , di/dt=100A/μs , $T_J$=25C | --- | 120 | --- | nS |
| $Q_{rr}$ | Reverse Recovery Charge | | --- | 0.63 | --- | nC |

Note :
1.The data tested by surface mounted on a 1 inch$^2$ FR-4 board with 2OZ copper.
2.The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%
3.The EAS data shows Max. rating . The test condition is TJ = 25℃,VDD=200V,VGS=10V,L=60mH
4.The power dissipation is limited by 150℃ junction temperature
5.The data is theoretically the same as $I_D$ and $I_{DM}$ , in real applications , should be limited by total power dissipation.

## Typical Performance Characteristics

**Fig 1. Output Characteristics ($T_j$=25℃)**

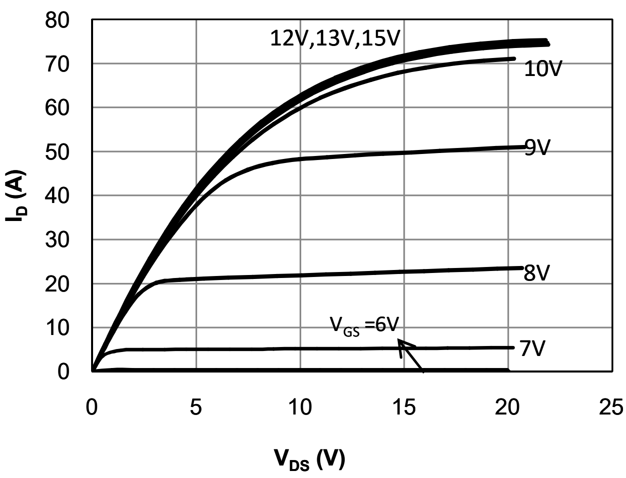



**Fig 2. Output Characteristics ($T_j$=150℃)**

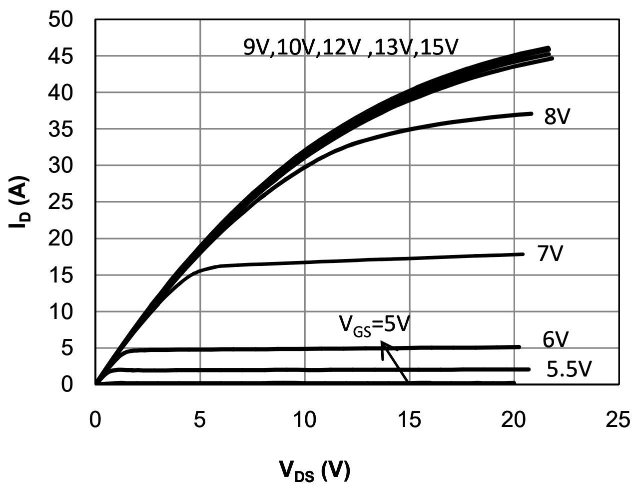



**Fig 3: Transfer Characteristics**

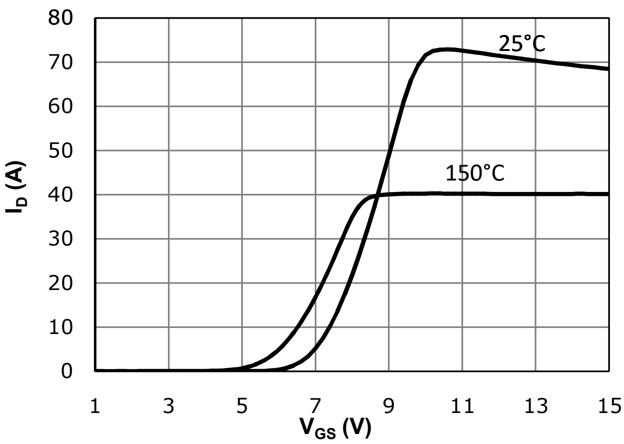



**Fig 4: $V_{TH}$ vs. $T_j$ Temperature Characteristics**

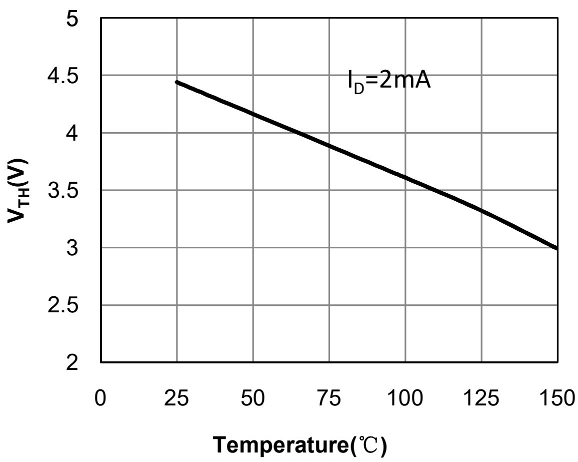



**Fig 5: $R_{DS(on)}$ vs. $I_{DS}$ Characteristics($T_j$=25℃)**

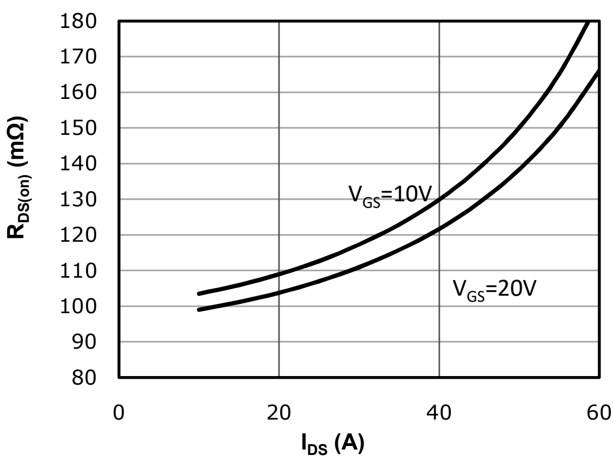



**Fig 6: $R_{DS(on)}$ vs. Temperature**

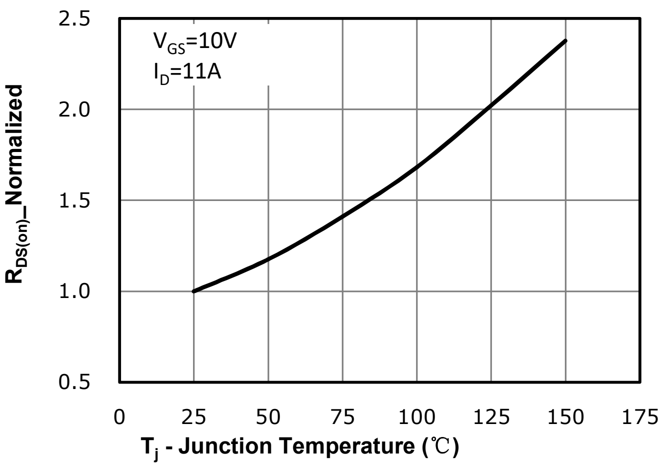


**Fig 7: $BV_{DSS}$ vs. Temperature**

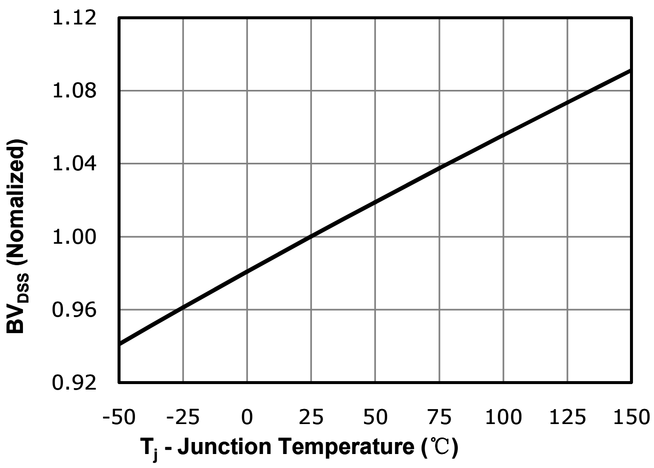



**Fig 8: $R_{DS(on)}$ vs. Gate Voltage**

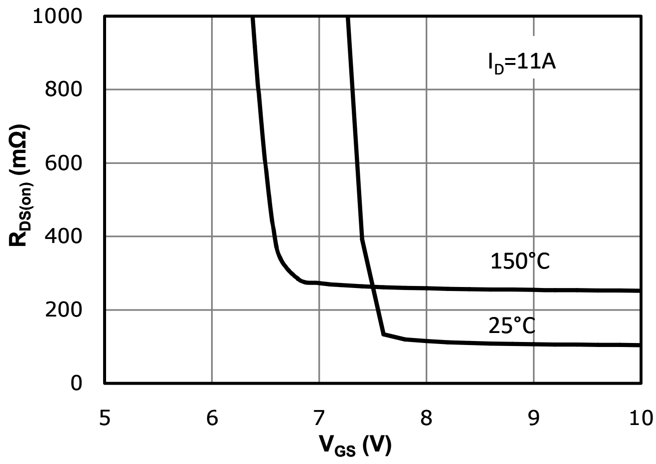



**Fig 9: Body-diode Forward Characteristics**

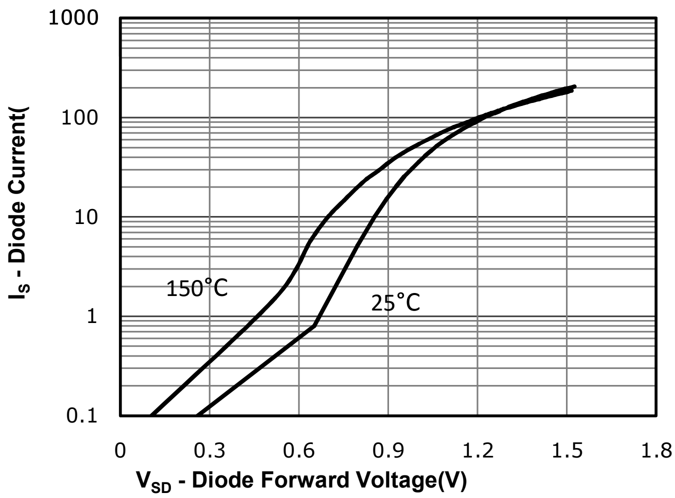



**Fig 10: Gate Charge Characteristics**

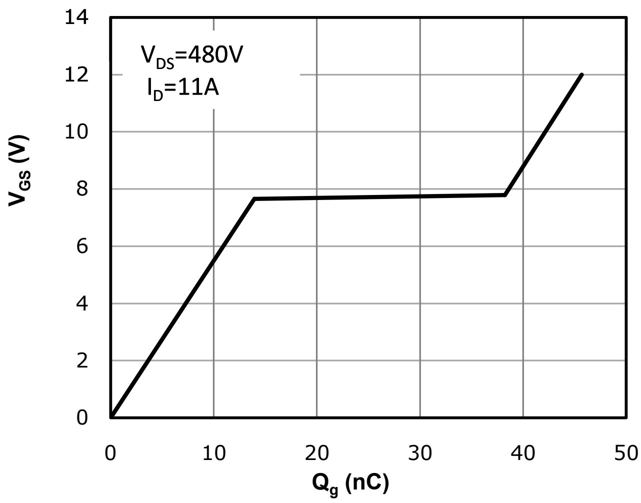



**Fig 11: Capacitance Characteristics**

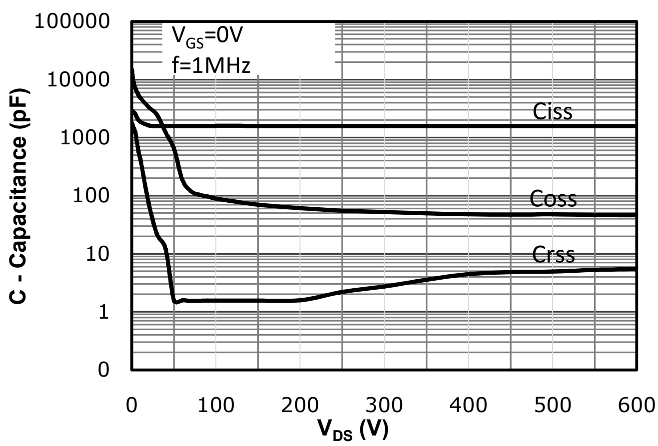



**Fig 12: Safe Operating Area**

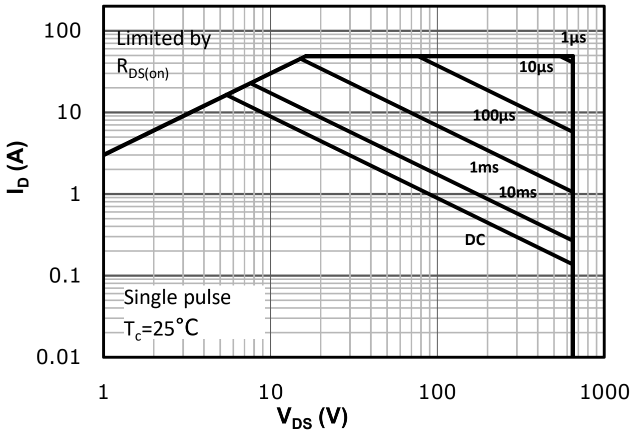
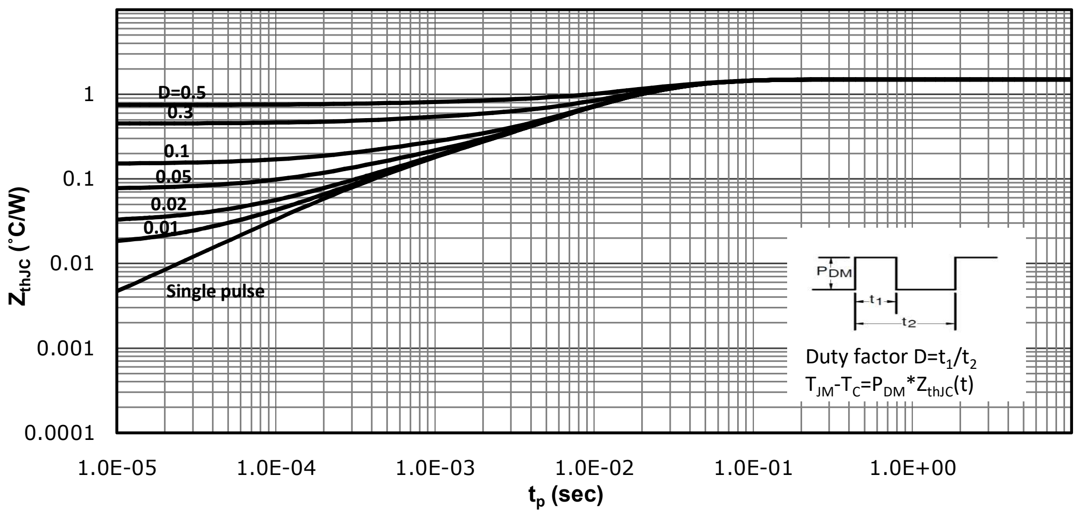
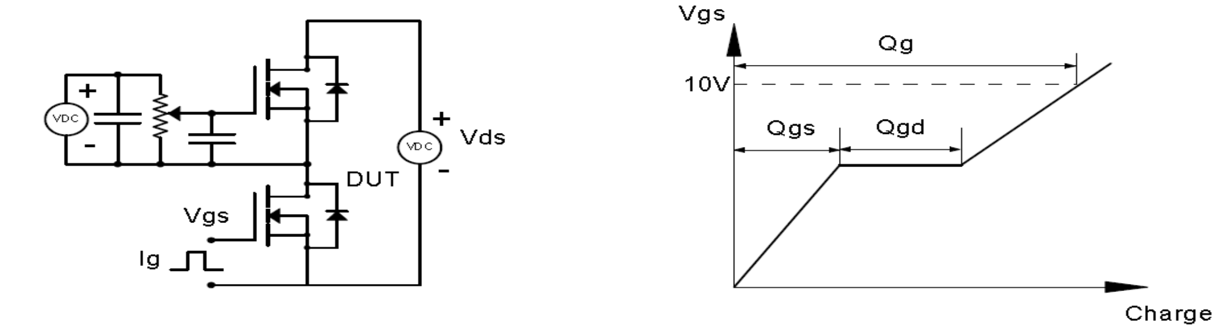


Fig 13: Max. Transient Thermal Impedance

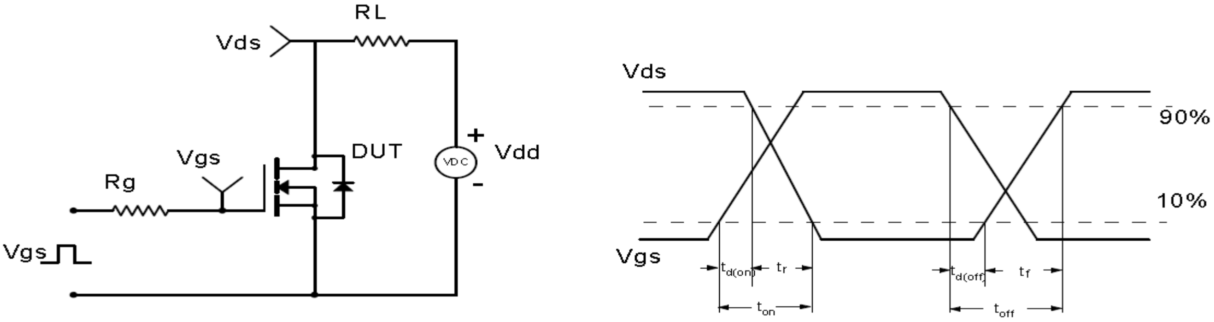


## Test Circuit & Waveform

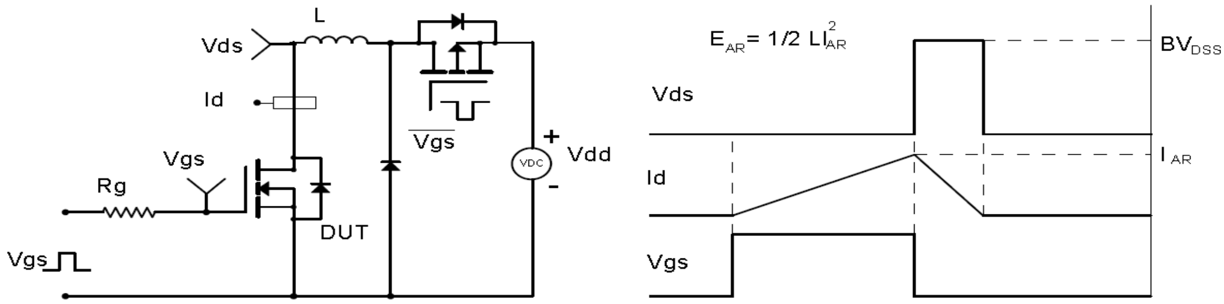
Gate Charge Test Circuit & Waveform



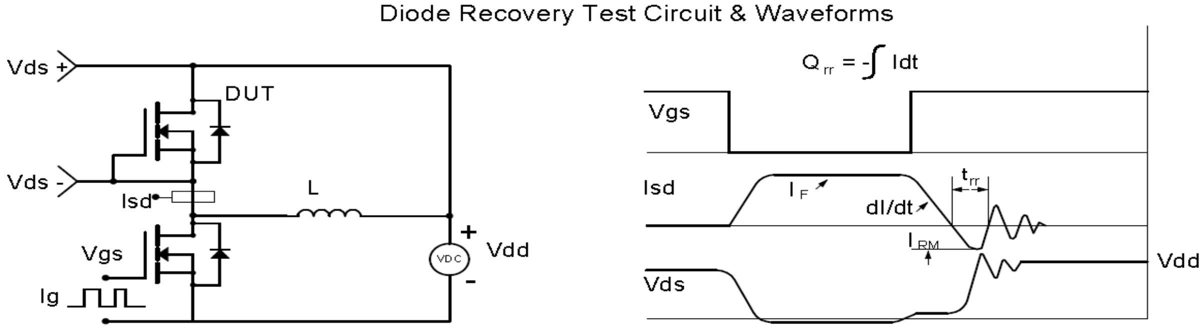

Resistive Switching Test Circuit & Waveforms



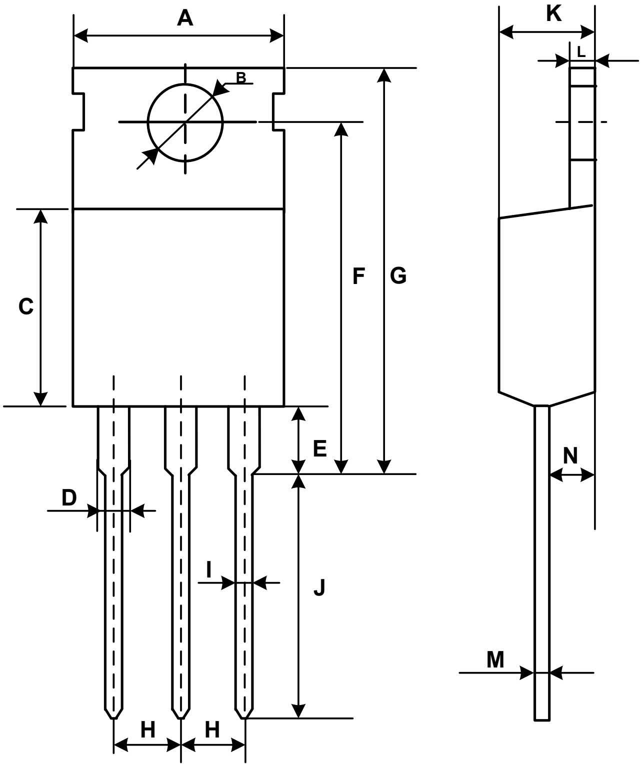

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms




Diode Recovery Test Circuit & Waveforms



**Mechanical Dimensions for TO-220**




OMMON DIMENSIONS

| SYMBOL | MM | |
|---|---|---|
| | MIN | MAX |
| A | 9.70 | 10.30 |
| B | 3.40 | 3.80 |
| C | 8.80 | 9.40 |
| D | 1.17 | 1.47 |
| E | 2.60 | 3.50 |
| F | 15.10 | 16.70 |
| G | 19.55MAX | |
| H | 2.54REF | |
| I | 0.70 | 0.95 |
| J | 9.35 | 11.00 |
| K | 4.30 | 4.77 |
| L | 1.20 | 1.45 |
| M | 0.40 | 0.65 |
| N | 2.20 | 2.60 |