★ 100% EAS Guaranteed
★ Green Device Available
★ Super Low Gate Charge
★ Excellent CdV/dt effect decline
★ Advanced high cell density Trench technology

## Product Summary

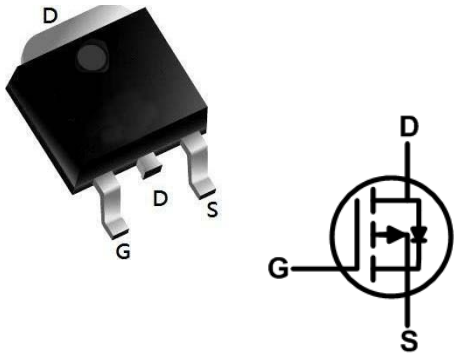
Green

| BVDSS | RDSON | ID |
|---|---|---|
| -100V | 31mΩ | -40A |

## Description

The XR40P10 is the high cell density trenched P-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.
The XR40P10 meet the RoHS and Green Product requirement 100% EAS guaranteed with full function reliability approved.

## TO252-3L Pin Configuration




## Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-source voltage | $V_{DS}$ | -100 | V |
| Continuous drain current<br>$T_C$ = 25°C (Silicon limit) $T_C$ =<br>25°C (Package limit) $T_C$ =<br>100°C (Silicon limit) | $I_D$ | <br>-40<br>-66<br>-21 | A |
| Pulsed drain current ($T_C$ = 25°C, $t_p$ limited by $T_{jmax}$) | $I_{D\ pulse}$ | -135 | A |
| Avalanche energy, single pulse (L=0.5mH, Rg=25Ω) | $E_{AS}$ | 95 | mJ |
| Gate-Source voltage | $V_{GS}$ | ±20 | V |
| Power dissipation ($T_C$ = 25°C) | $P_{tot}$ | 94 | W |
| Operating junction and storage temperature | $T_j$ , $T_{stg}$ | -55...+150 | °C |
| Solldering temperature, wave soldering only allowed at leads (1.6mm from case for 10s) | $T_{sold}$ | 260 | °C |

## Thermal Resistance

| Parameter | Symbol | Max | Unit |
|---|---|---|---|
| Thermal resistance, junction – case. | $R_{thJC}$ | 1.33 | °C/W |
| Thermal resistance, junction – ambient(min. footprint) | $R_{thJA}$* | 129 | |

## 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, $I_D$=-250uA |
| Gate threshold voltage | $V_{GS(th)}$ | -1.5 | -2.0 | -2.5 | V | $V_{DS}$=$V_{GS}$,$I_D$=-250uA |
| Zero gate voltage drain current | $I_{DSS}$ | -<br>- | -<br>- | -1<br>-50 | μA | $V_{DS}$=-100V,$V_{GS}$=0V<br>$T_j$=25°C<br>$T_j$=150°C |
| Gate-source leakage current | $I_{GSS}$ | - | - | ±100 | nA | $V_{GS}$=±20V,$V_{DS}$=0V |
| Drain-source on-state resistance | $R_{DS(on)}$ | -<br>-<br>- | 31<br>66<br>37 | 37<br>83<br>48 | mΩ | $V_{GS}$=-10V, $I_D$=-22A<br>$T_j$=25°C<br>$T_j$=150°C<br>VGS=-4.5V, $I_D$=-10A |
| Transconductance | $g_{fs}$ | - | 58 | - | S | $V_{DS}$=-5V,$I_D$=-22A |
| **Dynamic Characteristic** | | | | | | |
| Input Capacitance | $C_{iss}$ | - | 5805 | - | pF | $V_{GS}$=0V, $V_{DS}$=-50V, f=1MHz |
| Output Capacitance | $C_{oss}$ | - | 178 | - | | |
| Reverse Transfer Capacitance | $C_{rss}$ | - | 86 | - | | |
| Gate Total Charge | $Q_G$ | - | 100 | - | nC | $V_{GS}$=-10V, $V_{DS}$=-50V, $I_D$=-22A, f=1MHz |
| Gate-Source charge | $Q_{gs}$ | - | 25 | - | | |
| Gate-Drain charge | $Q_{gd}$ | - | 16 | - | | |
| Turn-on delay time | $t_{d(on)}$ | - | 15 | - | ns | $V_{GS}$=-10V, $V_{DD}$=-50V, $R_{G\_ext}$=2.7Ω, $I_D$=-22A |
| Rise time | $t_r$ | - | 44 | - | | |
| Turn-off delay time | $t_{d(off)}$ | - | 90 | - | | |
| Fall time | $t_f$ | - | 76 | - | | |
| Gate resistance | $R_G$ | - | 3.8 | - | Ω | $V_{GS}$=0V,$V_{DS}$=0V, f=1MHz |

## Body Diode Characteristic

| Parameter | Symbol | Value | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | min. | typ. | max. | | |
| Body Diode Forward Voltage | $V_{SD}$ | - | -0.87 | -1.3 | V | $V_{GS}$=0V,$I_{SD}$=-22A |
| Body Diode Forward Current | $I_S$ | | | -40 | A | $T_C$ = 25°C |
| Body Diode Reverse Recovery Time | $t_{rr}$ | - | 33 | - | ns | Isd=-22A, dI/dt=100A/μs |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | - | 54 | - | nC | |

*The value of $R_{thJA}$ is measured by placing the device in a still air box which is one cubic foot.

## Typical Performance Characteristics

Fig 1: Output Characteristics

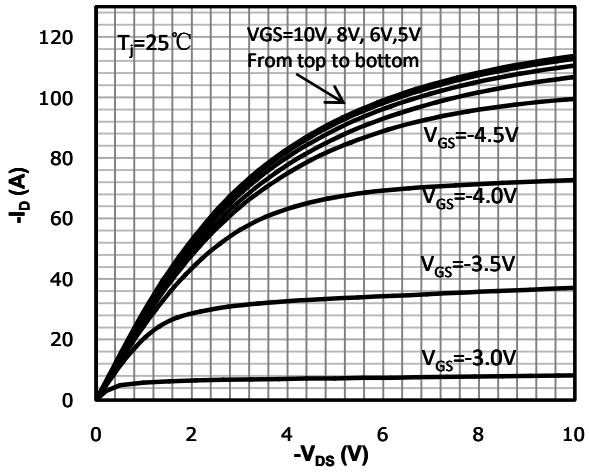



Fig 2: Transfer Characteristics

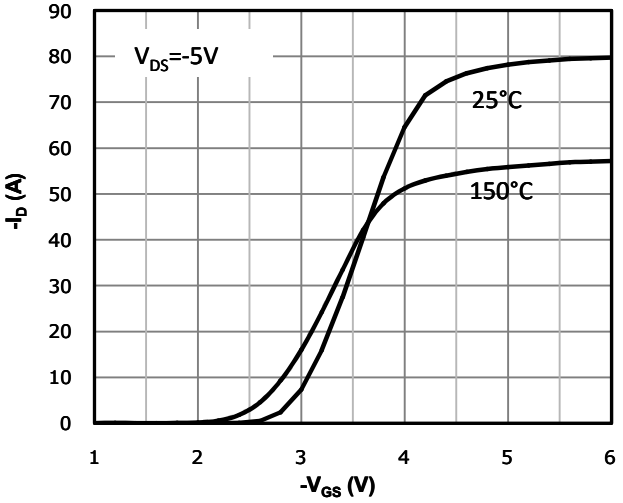



Fig 3: Rds(on) vs Drain Current and Gate Voltage

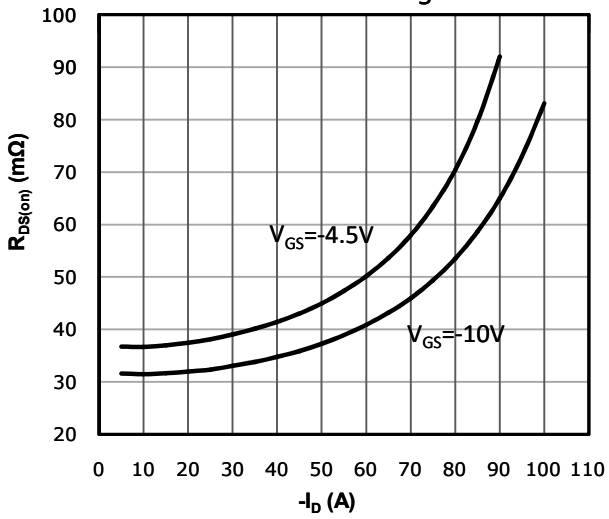



Fig 4: Rds(on) vs Gate Voltage

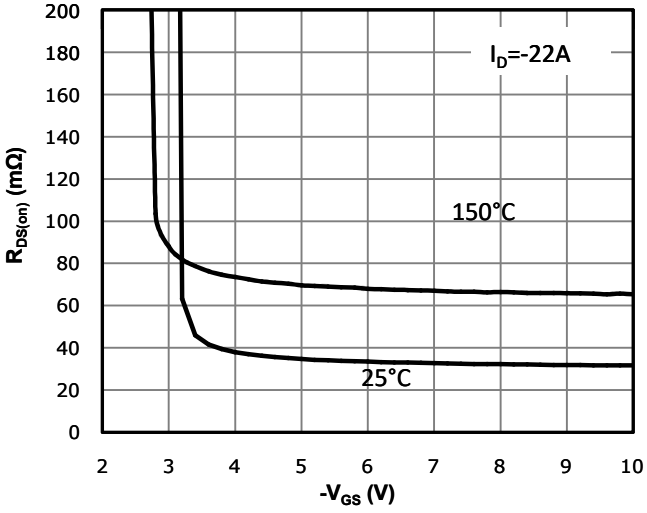



Fig 5: Rds(on) vs. Temperature

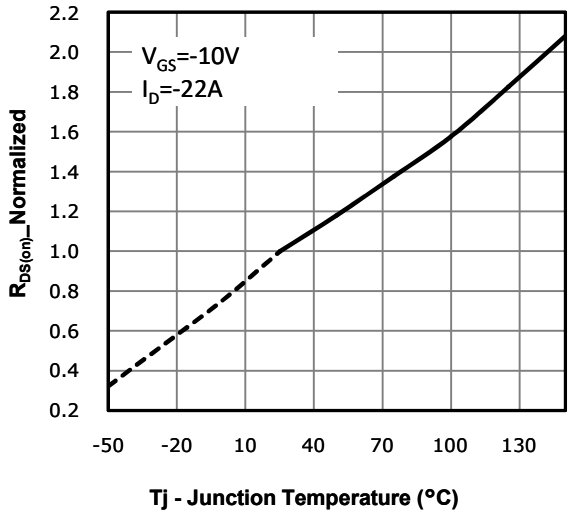



Fig 6: Capacitance Characteristics

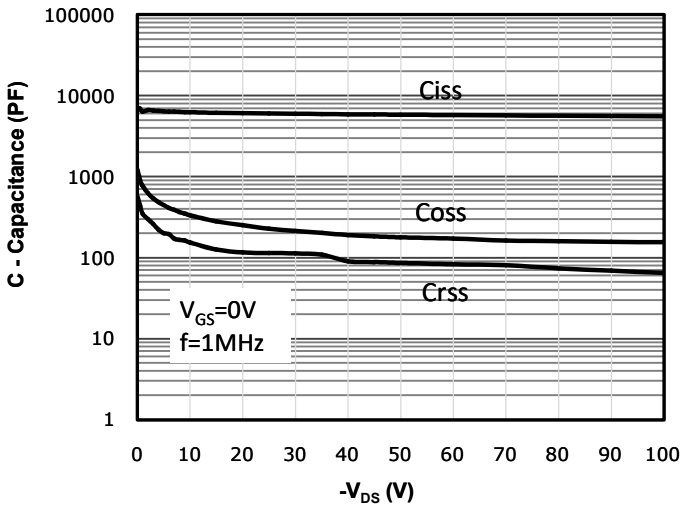


Fig 7: BVDS vs. Temperature

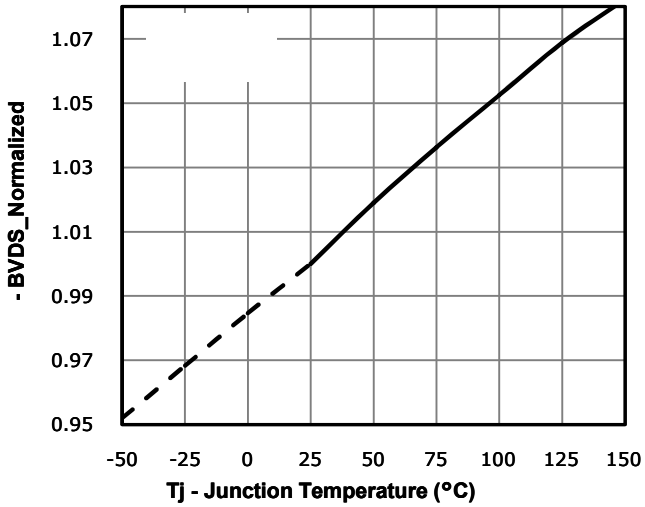



Fig 8: $V_{GS}$(th) vs. Temperature

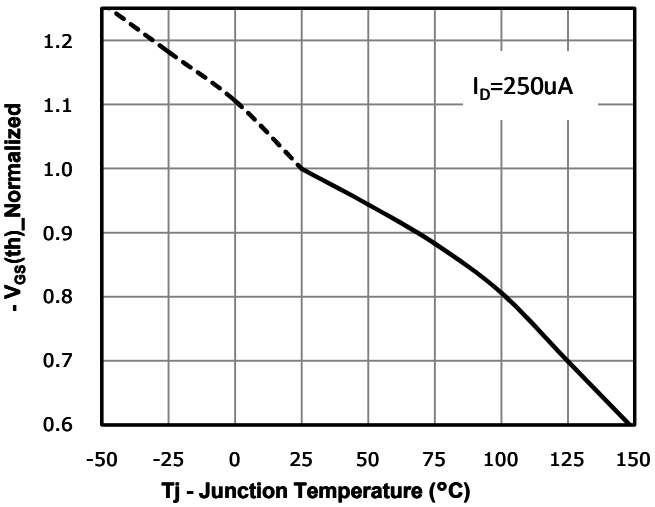



Fig 9: Gate Charge Characteristics

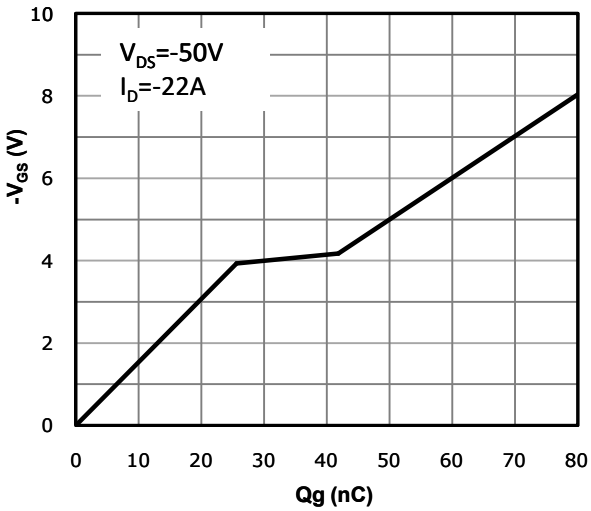



Fig 10: Body-diode Forward Characteristics

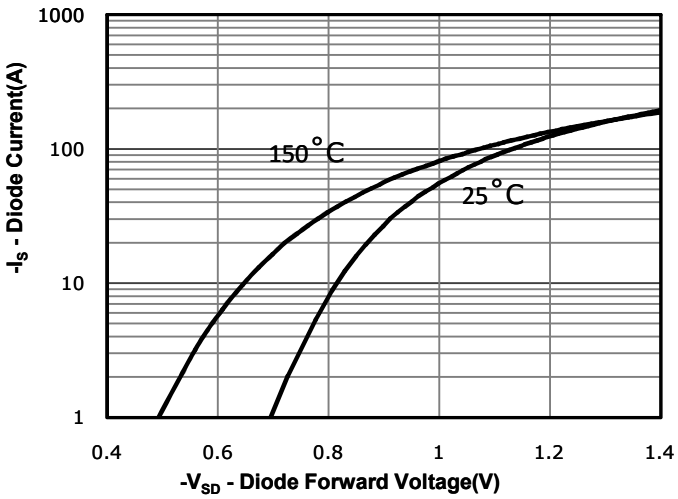



Fig 11: Power Dissipation

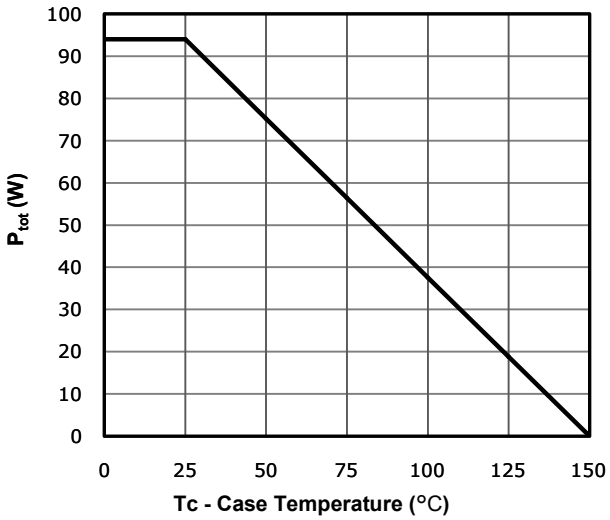



Fig 12: Drain Current Derating

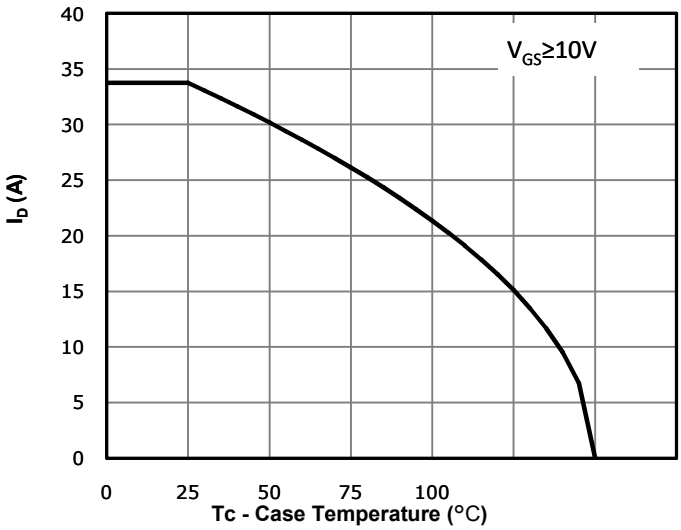


Fig 13: Safe Operating Area

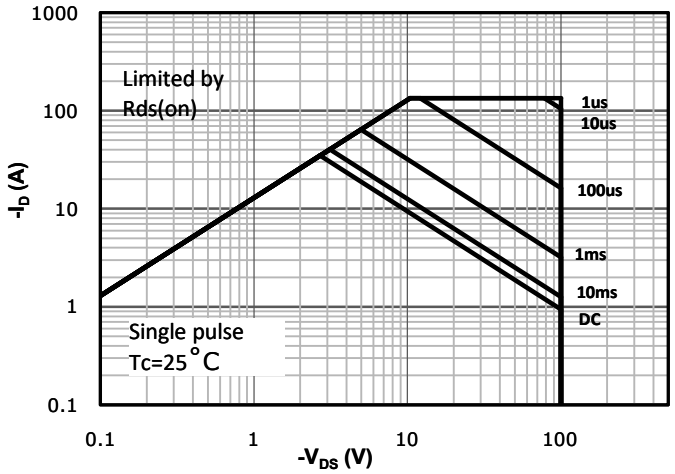
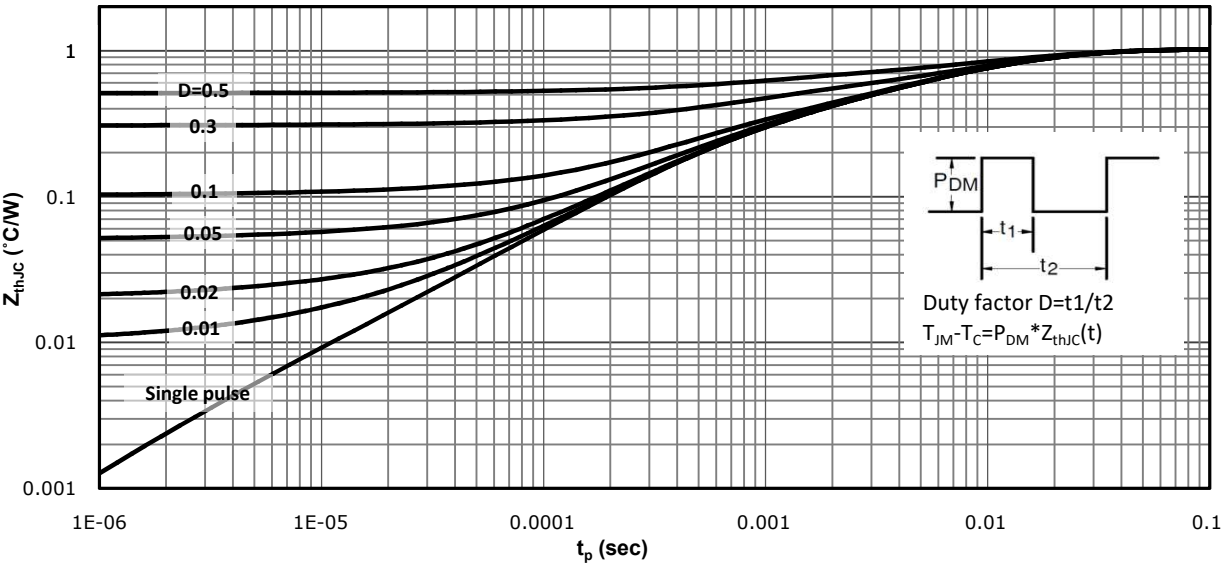
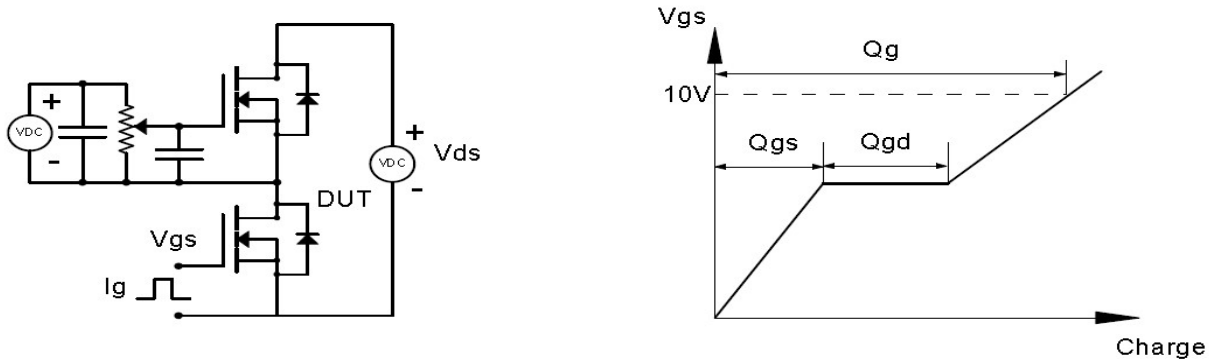



Fig 14: Max. Transient Thermal Impedance

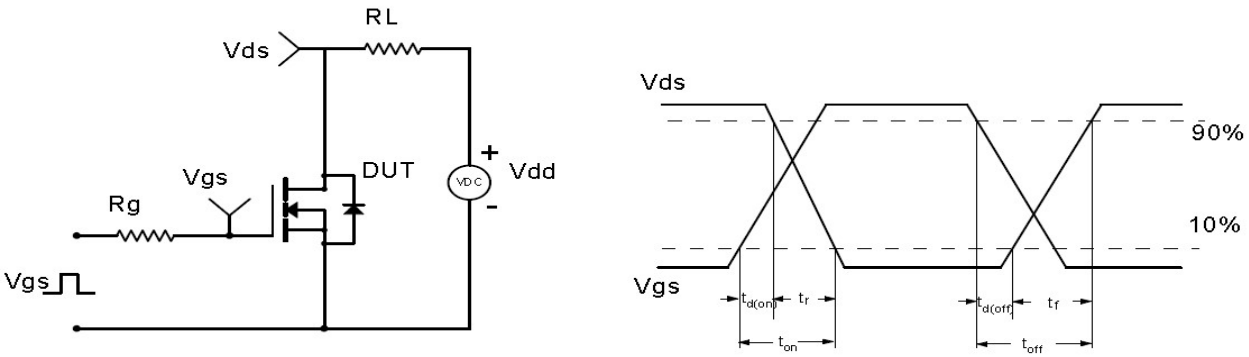


## Test Circuit & Waveform

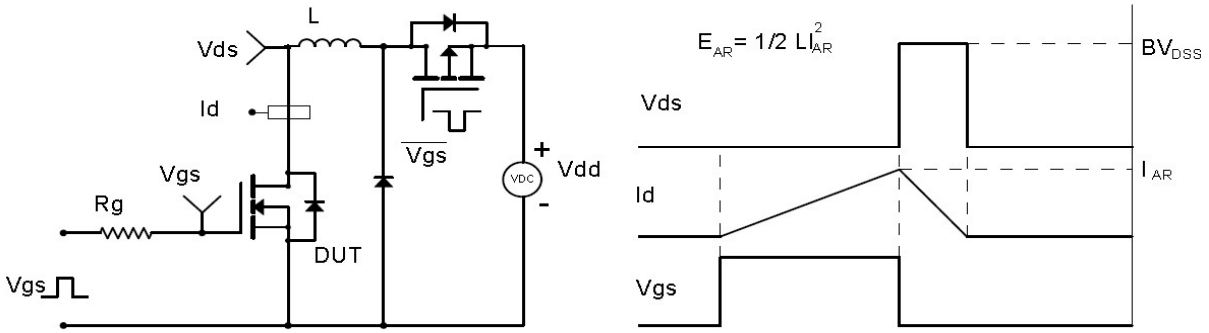
Gate Charge Test Circuit & Waveform



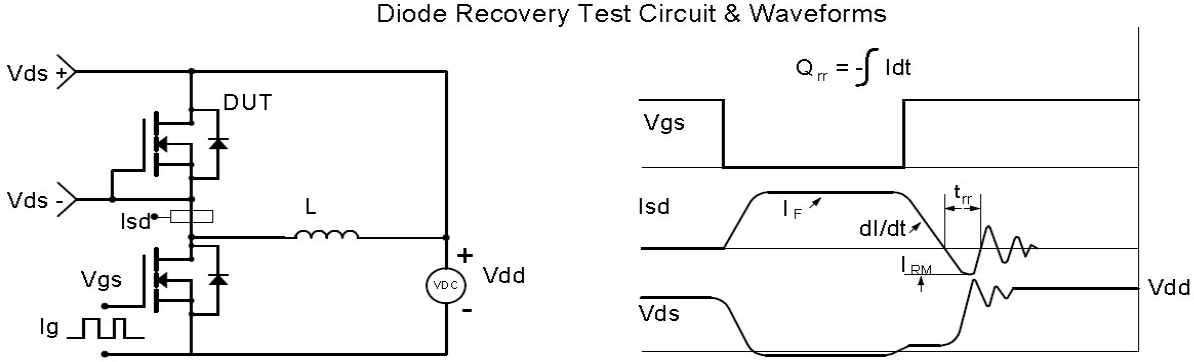

Resistive Switching Test Circuit & Waveforms



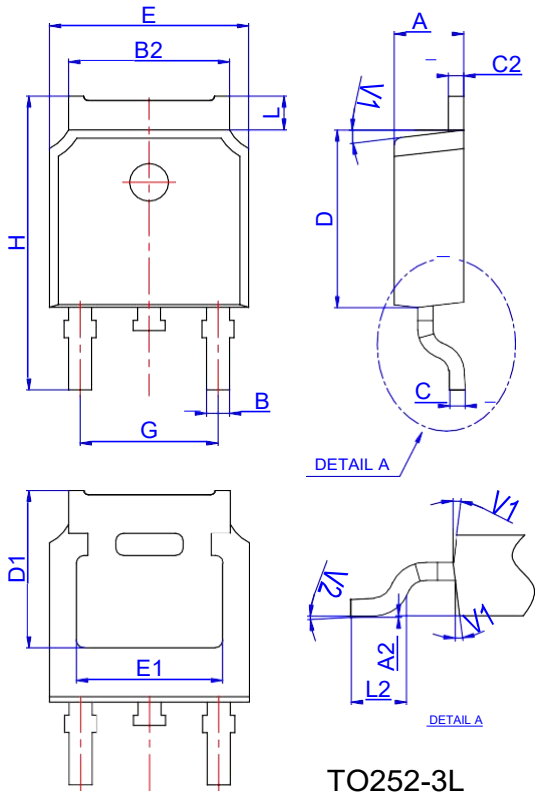

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms




Diode Recovery Test Circuit & Waveforms



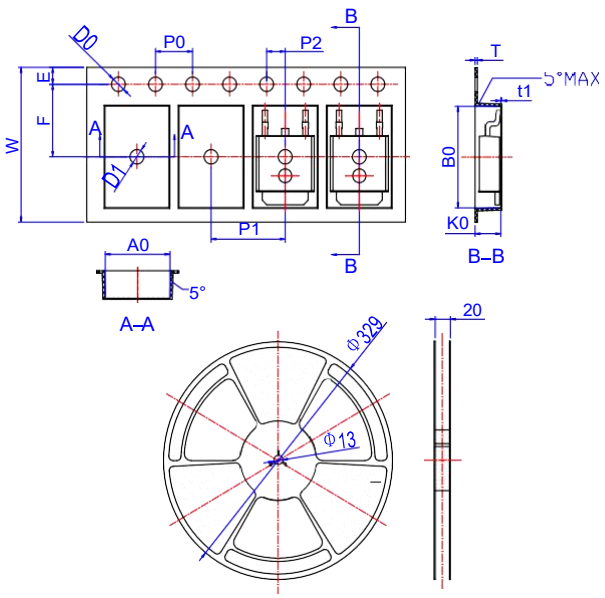
## Package Mechanical Data TO252-3L




TO252-3L

| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.10 | | 2.50 | 0.083 | | 0.098 |
| A2 | 0 | | 0.10 | 0 | | 0.004 |
| B | 0.66 | | 0.86 | 0.026 | | 0.034 |
| B2 | 5.18 | | 5.48 | 0.202 | | 0.216 |
| C | 0.40 | | 0.60 | 0.016 | | 0.024 |
| C2 | 0.44 | | 0.58 | 0.017 | | 0.023 |
| D | 5.90 | | 6.30 | 0.232 | | 0.248 |
| D1 | 5.30REF | | | 0.209REF | | |
| E | 6.40 | | 6.80 | 0.252 | | 0.268 |
| E1 | 4.63 | | | 0.182 | | |
| G | 4.47 | | 4.67 | 0.176 | | 0.184 |
| H | 9.50 | | 10.70 | 0.374 | | 0.421 |
| L | 1.09 | | 1.21 | 0.043 | | 0.048 |
| L2 | 1.35 | | 1.65 | 0.053 | | 0.065 |
| V1 | | 7° | | | 7° | |
| V2 | 0° | | 6° | 0° | | 6° |

## Reel Specification-TO252-3L




| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| W | 15.90 | 16.00 | 16.10 | 0.626 | 0.630 | 0.634 |
| E | 1.65 | 1.75 | 1.85 | 0.065 | 0.069 | 0.073 |
| F | 7.40 | 7.50 | 7.60 | 0.291 | 0.295 | 0.299 |
| D0 | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| D1 | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| P0 | 3.90 | 4.00 | 4.10 | 0.154 | 0.157 | 0.161 |
| P1 | 7.90 | 8.00 | 8.10 | 0.311 | 0.315 | 0.319 |
| P2 | 1.90 | 2.00 | 2.10 | 0.075 | 0.079 | 0.083 |
| A0 | 6.85 | 6.90 | 7.00 | 0.270 | 0.271 | 0.276 |
| B0 | 10.45 | 10.50 | 10.60 | 0.411 | 0.413 | 0.417 |
| K0 | 2.68 | 2.78 | 2.88 | 0.105 | 0.109 | 0.113 |
| T | 0.24 | | 0.27 | 0.009 | | 0.011 |
| t1 | 0.10 | | | 0.004 | | |
| 10P0 | 39.80 | 40.00 | 40.20 | 1.567 | 1.575 | 1.583 |