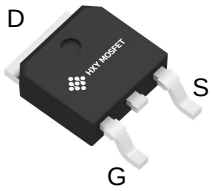
## Description

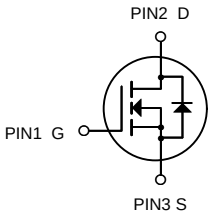
The SMIRF4N65T9RL can be used in various power swithching circuit for system miniaturization and higher efficiency.The package form is TO-252-2L, which accords with the RoHS standard.




**TO-252-2L**

## General Features

$V_{DS}$ = 650V,$I_D$ =4A
$R_{DS(ON)}$ < 2.7Ω@ $V_{GS}$=10V




N-Channel MOSFET

## Application

- Power switch circuit of adaptor and charger.

## Package Marking and Ordering Information

| Product ID | Pack | Brand | Qty(PCS) |
|---|---|---|---|
| SMIRF4N65T9RL | TO-252-2L | HXY MOSFET | 2500 |

## Absolute Maximum Ratings@$T_j$=25°C(unless otherwise specified)

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| VDS | Drain-Source Voltage | 650 | V |
| VGS | Gate-Source Voltage | ±30 | V |
| $I_D$@$T_C$=25°C | Drain Current, $V_{GS}$ @ 4.5V | 4 | A |
| $I_D$@$T_C$=100°C | Drain Current, $V_{GS}$ @ 4.5V | 2.5 | A |
| IDM | Pulsed Drain Current[1] | 16 | A |
| $P_D$@$T_C$=25°C | Total Power Dissipation | 75 | W |
| $E_{AS}$ | Single Pulse Avalanche Energy[4] | 200 | mJ |
| TSTG | Storage Temperature Range | -45 to 125 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -45 to 125 | ℃ |

**Electrical Characteristics** (TJ= 25°C unless otherwise specified)：

| **OFF Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Unit |
| | | | Min. | Typ. | Max. | s |
| $V_{DSS}$ | Drain to Source Breakdown Voltage | $V_{GS}$=0V, $I_D$=250μA | 650 | -- | -- | V |
| $\Delta BV_{DSS}/\Delta T_J$ | Bvdss Temperature Coefficient | ID=250uA,Reference25°C | -- | 0.67 | -- | V/°C |
| $I_{DSS}$ | Drain to Source Leakage Current | $V_{DS}$ =650V, $V_{GS}$= 0V, $T_J$ = 25°C | -- | -- | 1 | μA |
| | | $V_{DS}$ =520V, $V_{GS}$= 0V, $T_J$ = 125°C | -- | -- | 100 | μA |
| $I_{GSS(F)}$ | Gate to Source Forward Leakage | $V_{GS}$ =+30V | -- | -- | 100 | nA |
| $I_{GSS(R)}$ | Gate to Source Reverse Leakage | $V_{GS}$ =-30V | -- | -- | -100 | nA |

| **ON Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $R_{DS(ON)}$ | Drain-to-Source On-Resistance | $V_{GS}$=10V,$I_D$=2A | -- | 2.4 | 2.7 | Ω |
| $V_{GS(TH)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | 2.0 | -- | 4.0 | V |
| Pulse width tp≤300μs,δ≤2% | | | | | | |

| **Dynamic Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=15V, $I_D$ =2A | -- | 3.5 | -- | S |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V $V_{DS}$ = 25V f = 1.0MHz | -- | 610 | -- | pF |
| $C_{oss}$ | Output Capacitance | | -- | 53 | -- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 3.5 | -- | |

| **Resistive Switching Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $t_{d(ON)}$ | Turn-on Delay Time | $I_D$ =4A $V_{DD}$ = 325V $R_G$ =10Ω | -- | 14 | -- | ns |
| tr | Rise Time | | -- | 16 | -- | |
| $t_{d(OFF)}$ | Turn-Off Delay Time | | -- | 32 | -- | |
| $t_f$ | Fall Time | | -- | 11 | -- | |
| $Q_g$ | Total Gate Charge | $I_D$ =4A $V_{DD}$ =520V $V_{GS}$ = 10V | -- | 14.5 | -- | nC |
| $Q_{gs}$ | Gate to Source Charge | | -- | 3 | -- | |
| $Q_{gd}$ | Gate to Drain (“Miller”)Charge | | -- | 6.5 | -- | |

| **Source-Drain Diode Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Rating | | | Units |
| | | | Min. | Typ. | Max. | |
| $I_S$ | Continuous Source Current (Body Diode) | $T_C$ = 25 °C | -- | -- | 4 | A |
| $I_{SM}$ | Maximum Pulsed Current (Body Diode) | | -- | -- | 16 | A |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=4.0A,$V_{GS}$=0V | -- | -- | 1.5 | V |
| trr | Reverse Recovery Time | $I_S$=4.0A,$T_j$ = 25℃ dI$_F$/dt=100A/us, $V_{GS}$=0V | -- | 256 | -- | ns |
| Qrr | Reverse Recovery Charge | | -- | 1200 | -- | nC |
| $I_{RRM}$ | Reverse Recovery Current | | -- | 9.4 | -- | A |
| Pulse width tp≤300μs,δ≤2% | | | | | | |

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | 1.67 | ℃/W |
| $R_{\theta JA}$ | Junction-to-Ambient | 100 | ℃/W |

[a1]: Repetitive rating; pulse width limited by maximum junction temperature
[a2]: L=10mH, $I_D$=6.3A, Start $T_J$=25°C
[a3]: $I_{SD}$ =4A,di/dt ≤100A/us,$V_{DD}$≤$BV_{DS,}$ Start $T_J$=25°C
[a4]: Recommend soldering temperature defined by IPC/JEDEC J-STD 020

## Characteristics Curve:

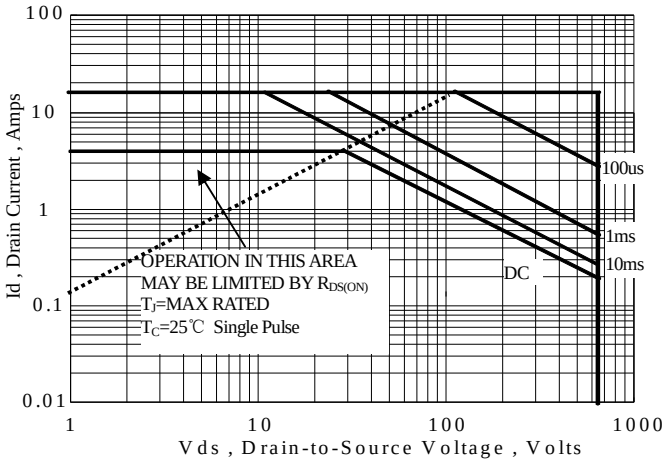



Figure 1 Maximum Forward Bias Safe Operating Area

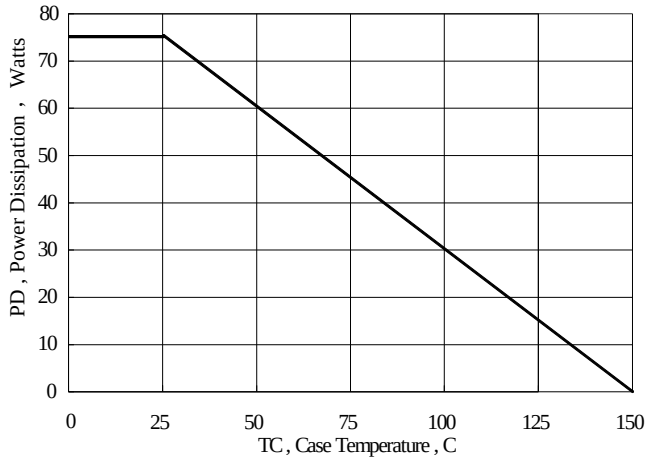



Figure 2 Maximum Power Dissipation vs Case Temperature

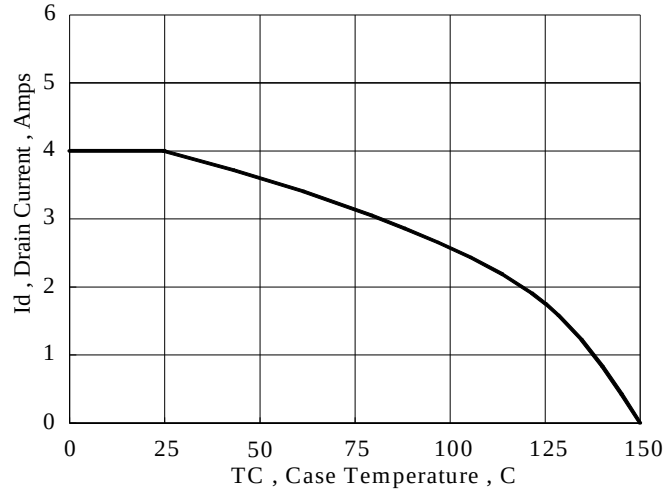



Figure 3 Maximum Continuous Drain Current vs Case Temperature

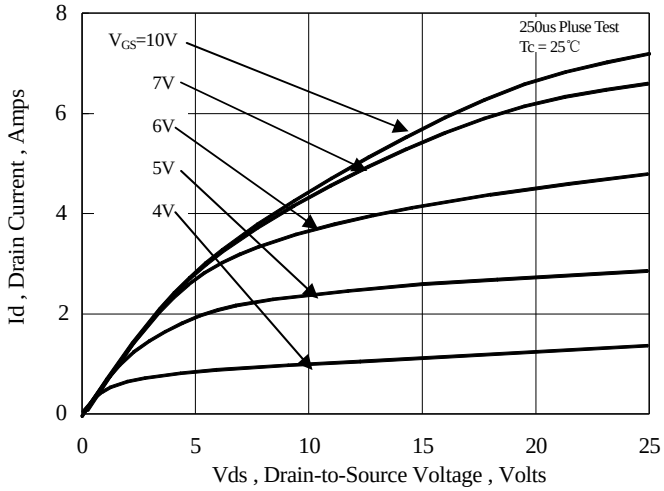



Figure 4 Typical Output Characteristics

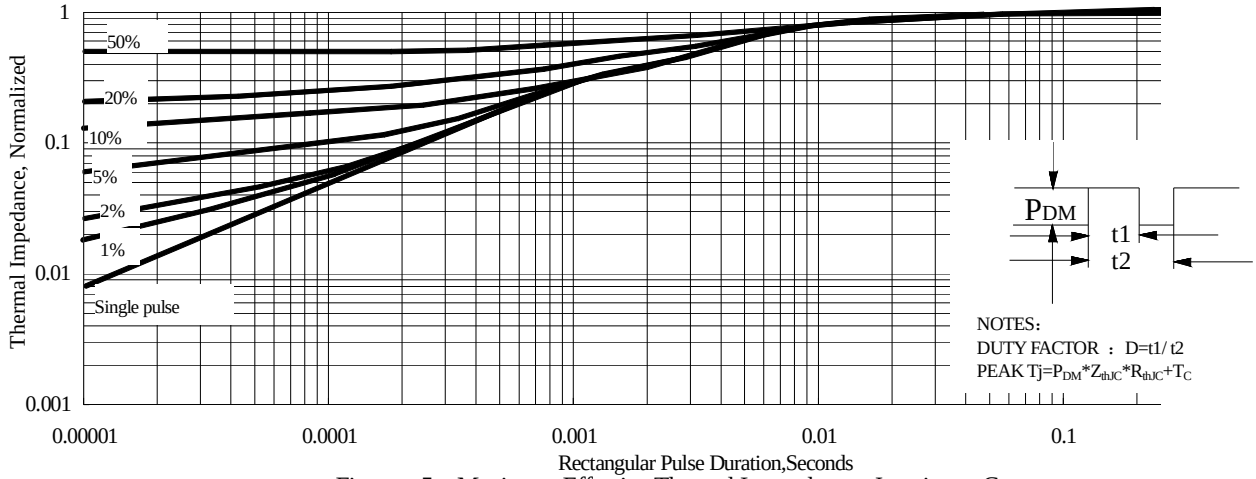



Figure 5 Maximum Effective Thermal Impendance , Junction to Case

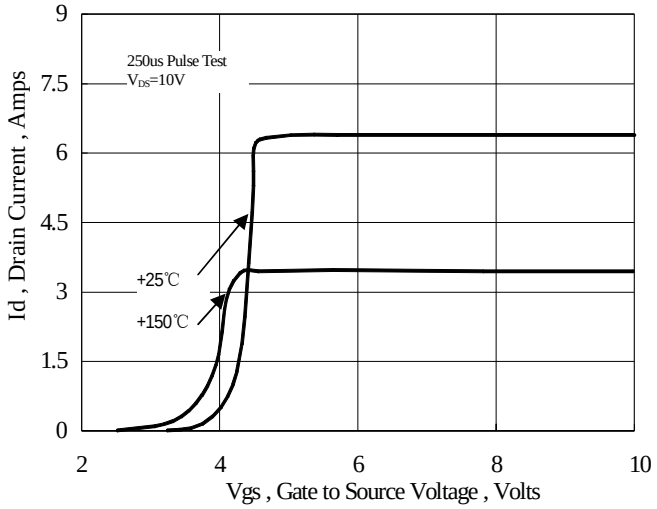



Figure 6 Typical Transfer Characteristics

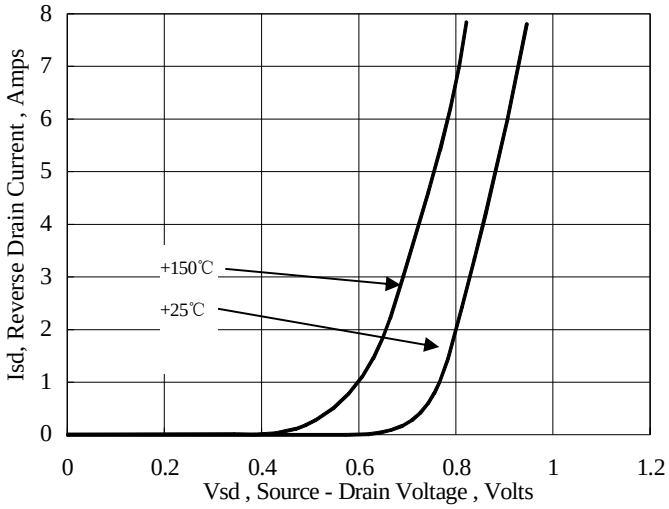



Figure 7 Typical Body Diode Transfer Characteristics

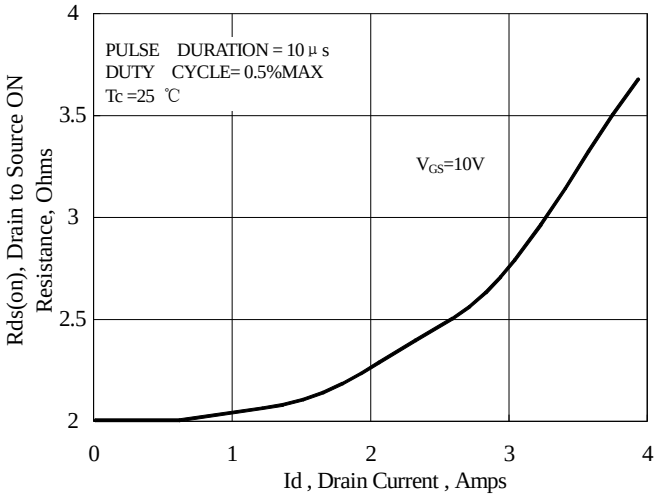



Figure 8 Typical Drain to Source ON Resistance vs Drain Current

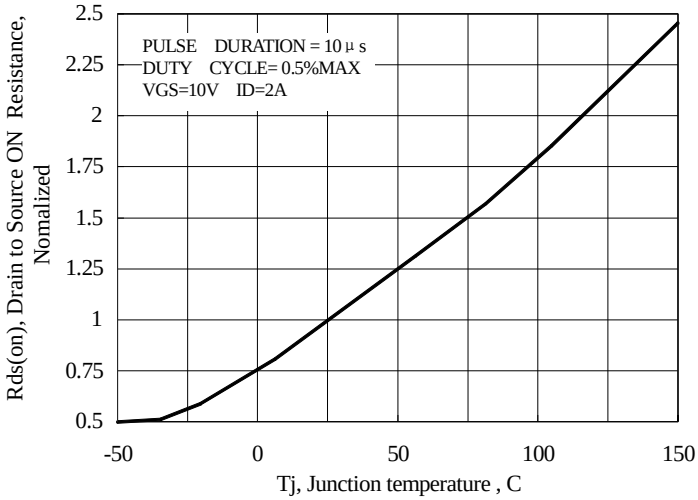



Figure 9 Typical Drian to Source on Resistance vs Junction Temperature

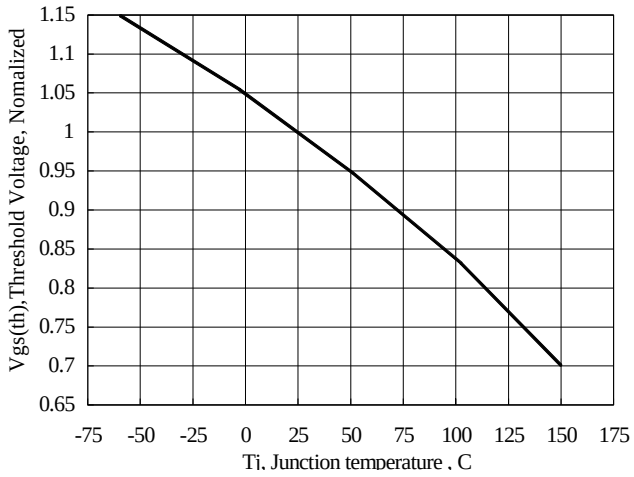



Figure 10 Typical Theshold Voltage vs Junction Temperature

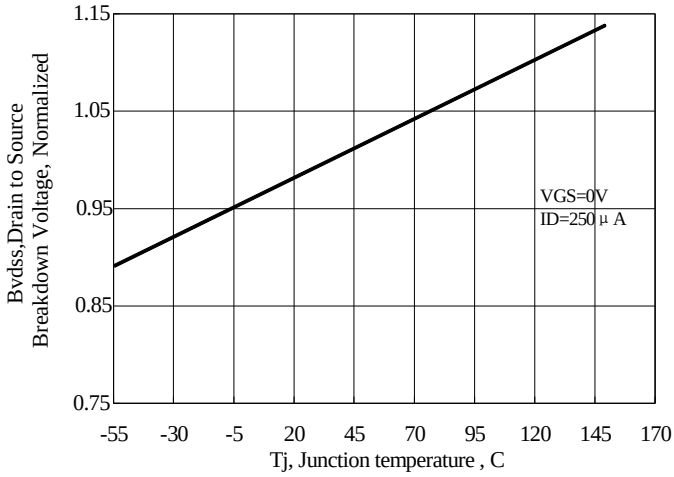



Figure 11 Typical Breakdown Voltage vs Junction Temperature

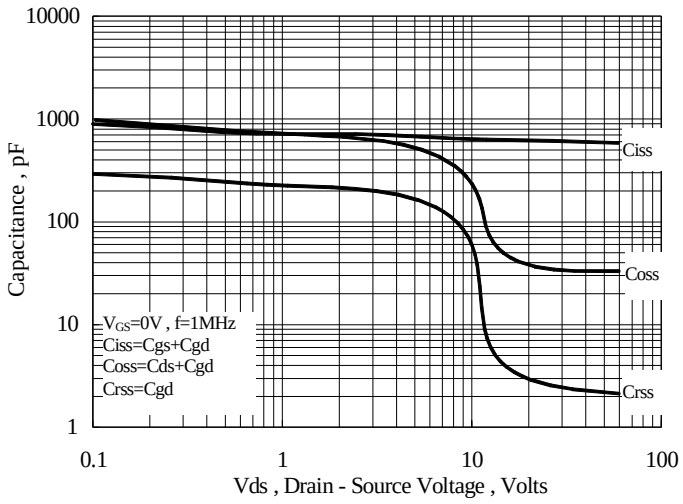



Figure 12 Typical Capacitance vs Drain to Source Voltage

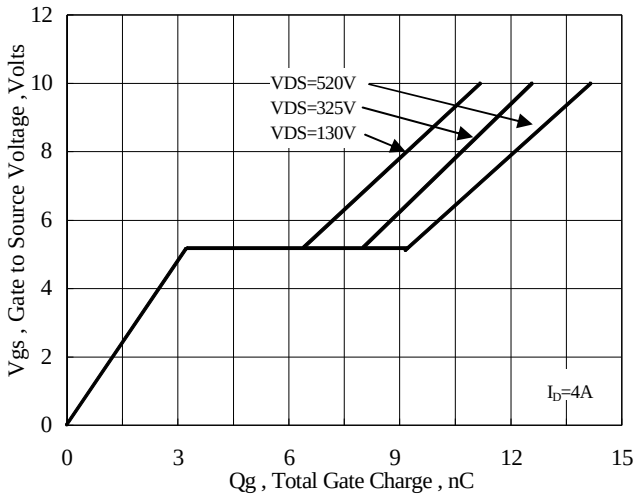



Figure 13 Typical Gate Charge vs Gate to Source Voltage

## Test Circuit and Waveform

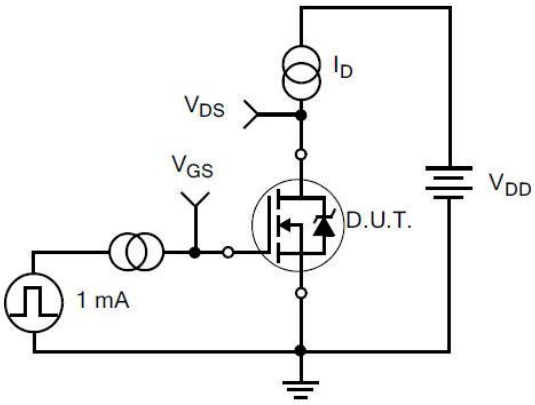



Figure 14. Gate Charge Test Circuit

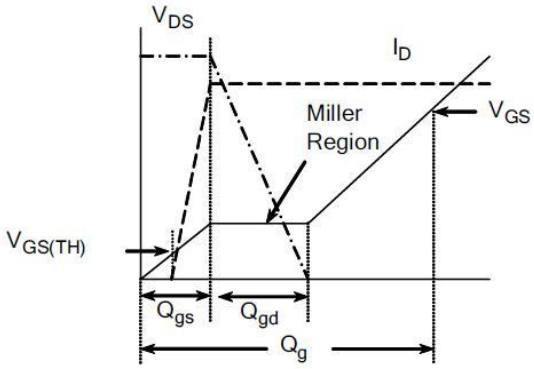



Figure 15. Gate Charge Waveforms

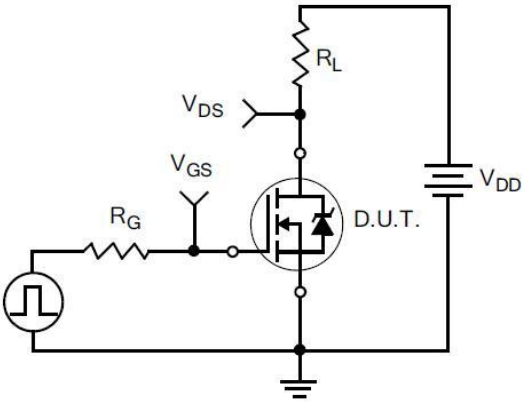



Figure 16. Resistive Switching Test Circuit

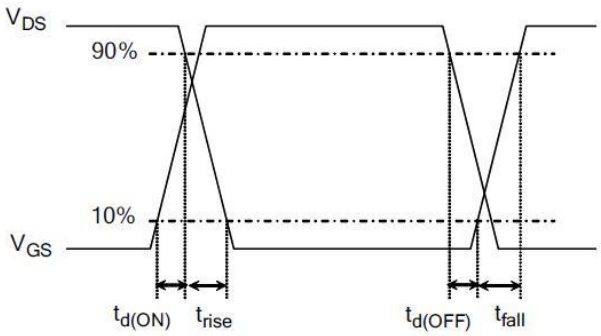



Figure 17. Resistive Switching Waveforms

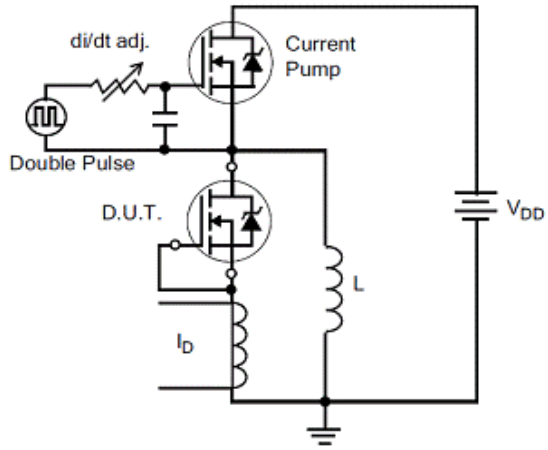



Figure 18. Diode Reverse Recovery Test Circuit

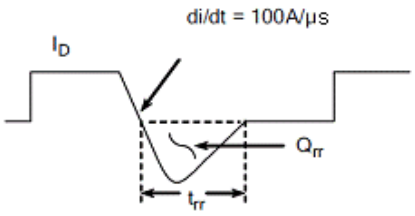



Figure 19. Diode Reverse Recovery Waveform

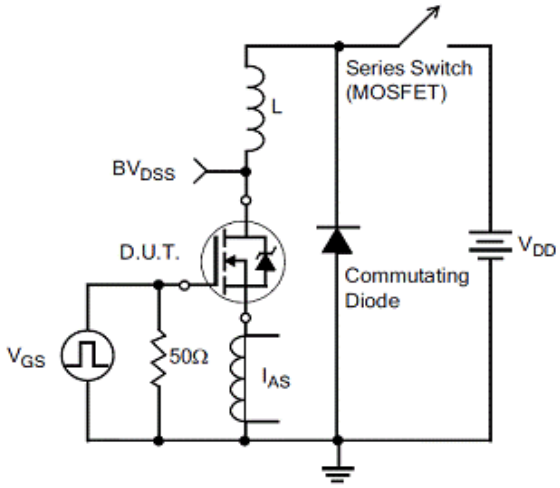



Figure20.Unclamped Inductive Switching Test Circuit

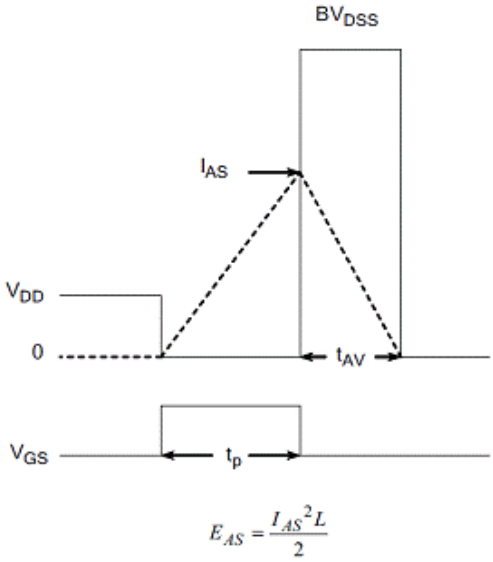
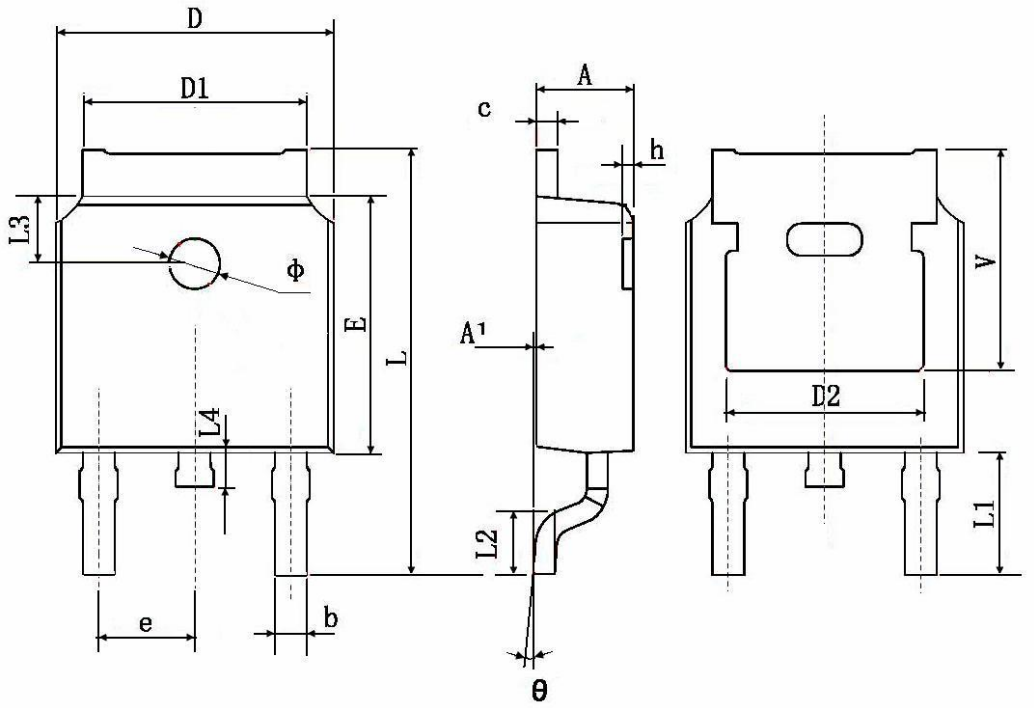



Figure21.Unclamped Inductive Switching Waveform

## TO-252-2L Package Information




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 2.200 | 2.400 | 0.087 | 0.094 |
| A1 | 0.000 | 0.127 | 0.000 | 0.005 |
| b | 0.660 | 0.860 | 0.026 | 0.034 |
| c | 0.460 | 0.580 | 0.018 | 0.023 |
| D | 6.500 | 6.700 | 0.256 | 0.264 |
| D1 | 5.100 | 5.460 | 0.201 | 0.215 |
| D2 | 0.483 TYP. | | 0.190 TYP. | |
| E | 6.000 | 6.200 | 0.236 | 0.244 |
| e | 2.186 | 2.386 | 0.086 | 0.094 |
| L | 9.800 | 10.400 | 0.386 | 0.409 |
| L1 | 2.900 TYP. | | 0.114 TYP. | |
| L2 | 1.400 | 1.700 | 0.055 | 0.067 |
| L3 | 1.600 TYP. | | 0.063 TYP. | |
| L4 | 0.600 | 1.000 | 0.024 | 0.039 |
| Φ | 1.100 | 1.300 | 0.043 | 0.051 |
| θ | 0° | 8° | 0° | 8° |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| V | 5.350 TYP. | | 0.211 TYP. | |

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## HXY MOSFET:

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