

TMP2070D

P -Channel Enhancement Mosfet

General Description

- Low $R_{DS(ON)}$
- RoHS and Halogen-Free Compliant

Applications

- Load switch
- PWM

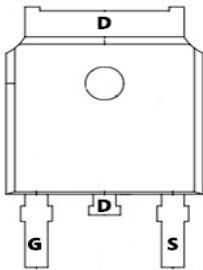
General Features

$V_{DS} = -20V$ $I_D = -70A$

$R_{DS(ON)} = 6.5m\Omega$ (typ.)@ $V_{GS} = -4.5V$

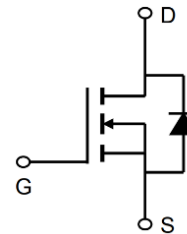
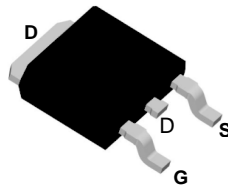
100% UIS Tested

100% R_g Tested



Marking: 70P02

D:TO-252-3L



Absolute Maximum Ratings ($T_C = 25^\circ C$ unless otherwise noted)

| Symbol | Parameter | Max. | Units |
|-----------------|---|---------------------|----------------|
| V_{DSS} | Drain-Source Voltage | -20 | V |
| V_{GSS} | Gate-Source Voltage | ± 12 | V |
| I_D | Continuous Drain Current | $T_C = 25^\circ C$ | -70 |
| | | $T_C = 100^\circ C$ | -39 |
| I_{DM} | Pulsed Drain Current ^{note1} | -240 | A |
| P_D | Power Dissipation | 70 | W |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Ambient | 2.1 | $^\circ C / W$ |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to +175 | $^\circ C$ |

Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Units |
|---|---|---|------|------|-----------|------------|
| Off Characteristic | | | | | | |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D = -250\mu A$ | -20 | - | - | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = -20V, V_{GS} = 0V,$ | - | - | -1 | μA |
| I_{GSS} | Gate to Body Leakage Current | $V_{DS} = 0V, V_{GS} = \pm 12V$ | - | - | ± 100 | nA |
| On Characteristics | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = -250\mu A$ | -0.5 | -0.7 | -1.0 | V |
| $R_{DS(on)}$ | Static Drain-Source on-Resistance <small>note3</small> | $V_{GS} = -4.5V, I_D = -15A$ | - | 6.5 | 8.5 | m Ω |
| | | $V_{GS} = -2.5V, I_D = -12A$ | - | 8 | 12 | |
| Dynamic Characteristics | | | | | | |
| C_{iss} | Input Capacitance | $V_{DS} = -10V, V_{GS} = 0V,$ $f = 1.0MHz$ | - | 4590 | - | pF |
| C_{oss} | Output Capacitance | | - | 505 | - | pF |
| C_{rss} | Reverse Transfer Capacitance | | - | 440 | - | pF |
| Q_g | Total Gate Charge | $V_{DS} = -10V, I_D = -15A,$ $V_{GS} = -4.5V$ | - | 46 | - | nC |
| Q_{gs} | Gate-Source Charge | | - | 7.3 | - | nC |
| Q_{gd} | Gate-Drain("Miller") Charge | | - | 10 | - | nC |
| Switching Characteristics | | | | | | |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = -10V, I_D = -14A,$ $R_{GEN} = 2.7\Omega,$ $V_{GS} = -10V$ | - | 8 | - | ns |
| t_r | Turn-on Rise Time | | - | 59 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | | - | 111 | - | ns |
| t_f | Turn-off Fall Time | | - | 43 | - | ns |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| I_S | Maximum Continuous Drain to Source Diode Forward Current | | - | - | -70 | A |
| I_{SM} | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | -240 | A |
| V_{SD} | Drain to Source Diode Forward Voltage | $V_{GS} = 0V, I_S = -20A$ | - | - | -1.2 | V |
| t_{rr} | Reverse Recovery Time | $T_J = 25^\circ\text{C}, I_{SD} = -15A,$ | - | 18 | - | ns |
| Q_{rr} | Reverse Recovery Charge | $V_{GS} = 0V$ $di/dt = -100A/\mu s$ | - | 7.7 | - | nC |

- Notes: 1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
 2. EAS condition: $T_J = 25^\circ\text{C}, V_{DD} = -10V, V_G = -10V, R_G = 5.9\Omega, L = 0.5\text{mh}, I_{AS} = -13.2A$
 3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 0.5\%$

Typical Performance Characteristics

Figure 1: Output Characteristics

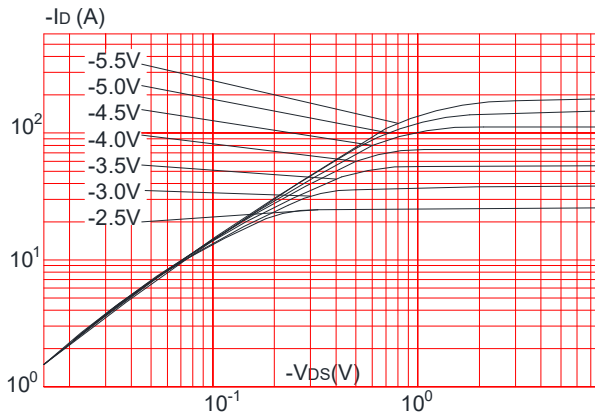


Figure 2: Typical Transfer Characteristics

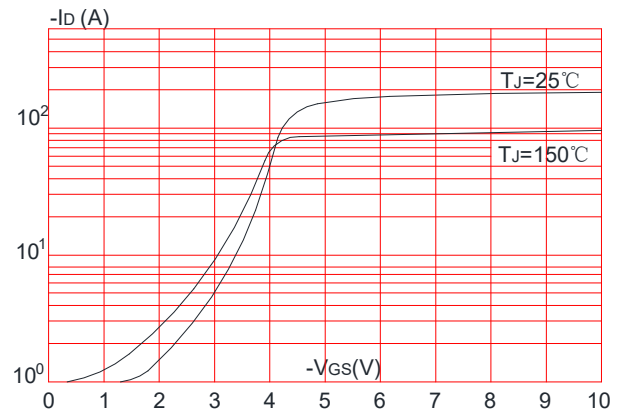


Figure 3: On-resistance vs. Drain Current

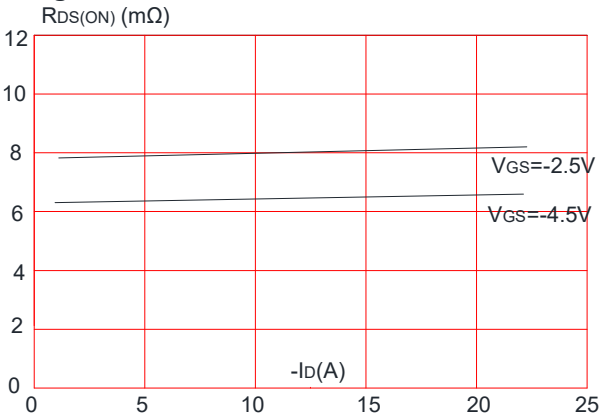


Figure 4: Body Diode Characteristics

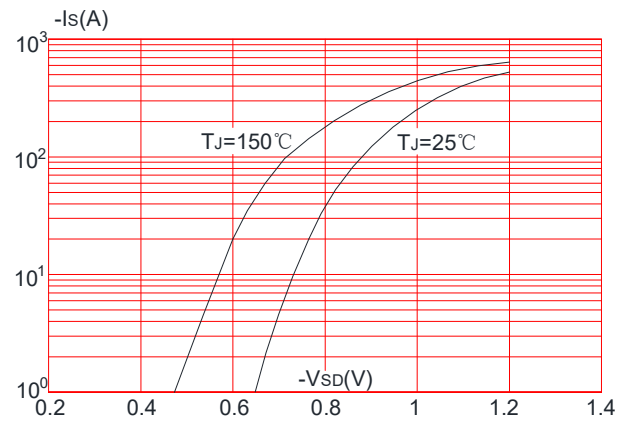


Figure 5: Gate Charge Characteristics

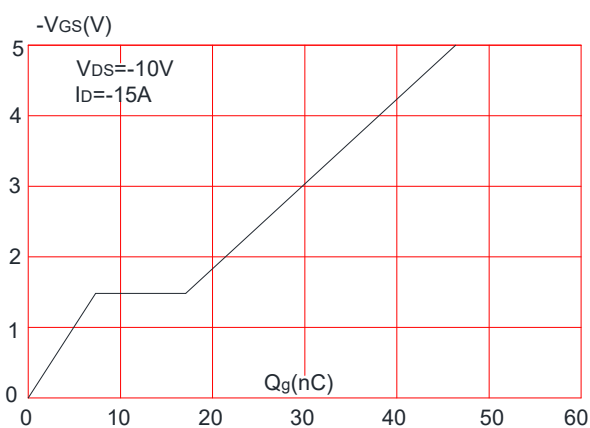
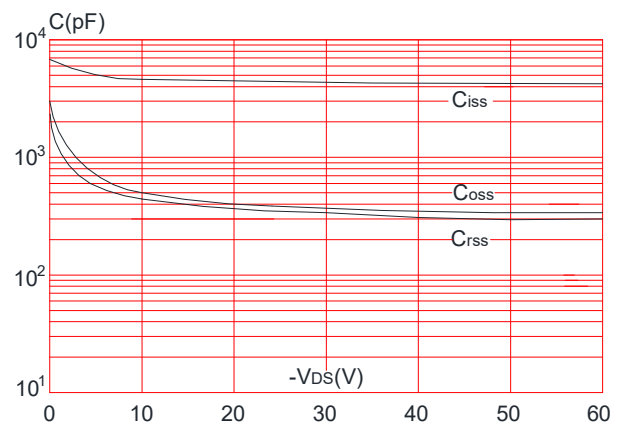


Figure 6: Capacitance Characteristics



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Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

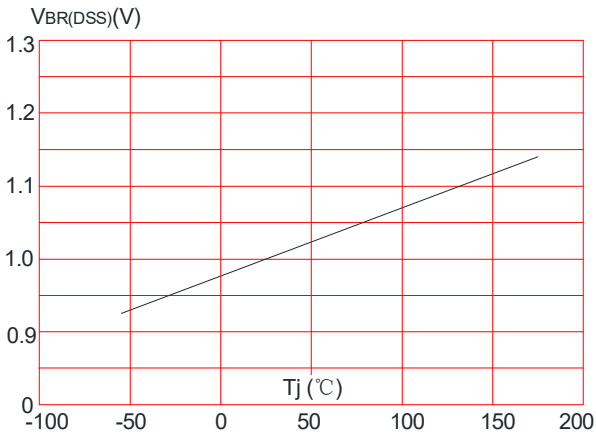


Figure 8: Normalized on Resistance vs. Junction Temperature

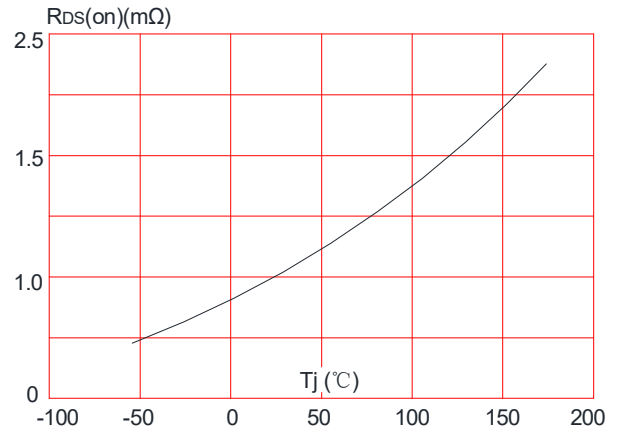


Figure 9: Maximum Safe Operating Area

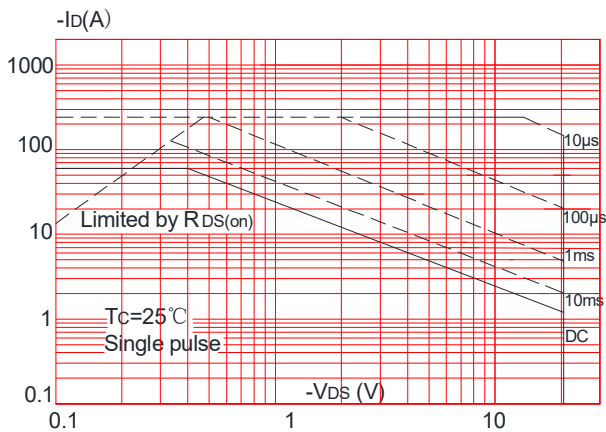


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

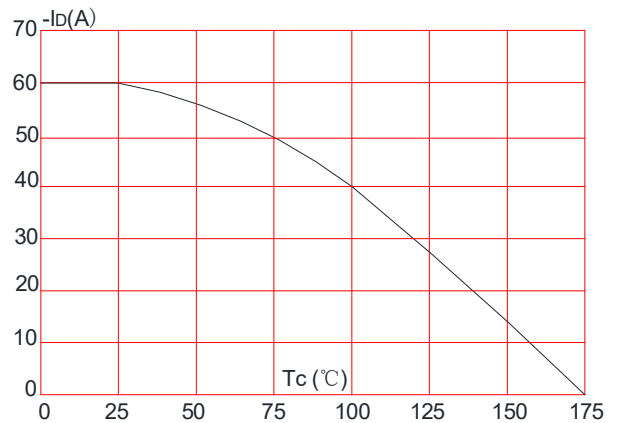
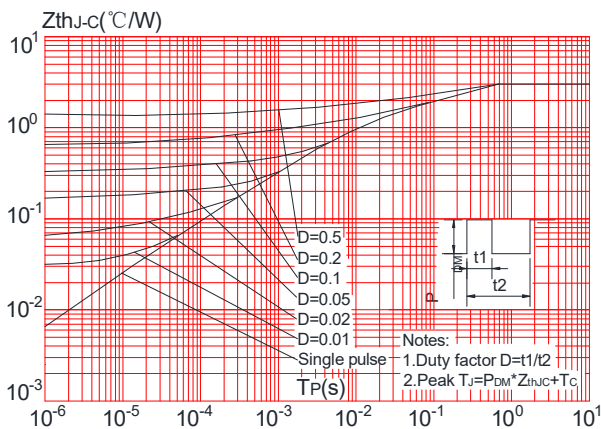
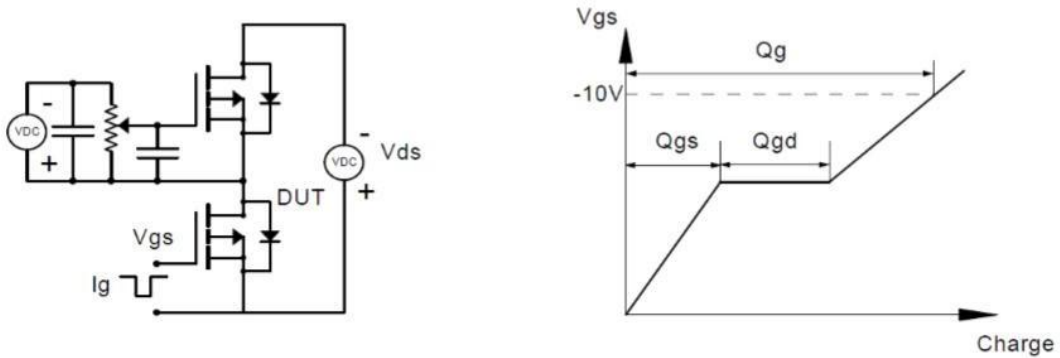


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case

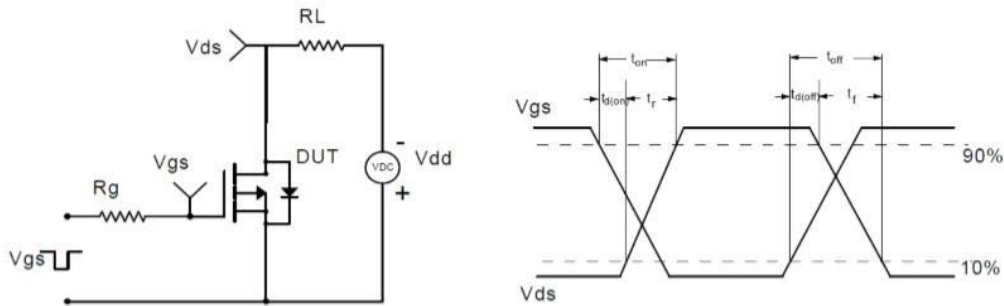


Test Circuit

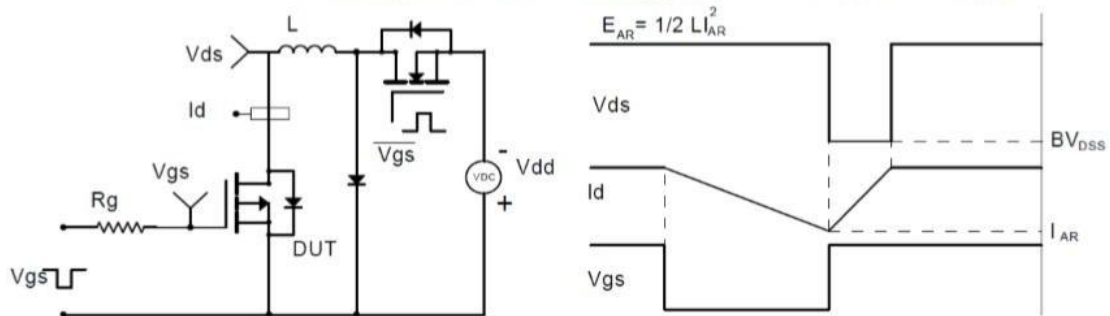
Gate Charge Test Circuit & Waveform



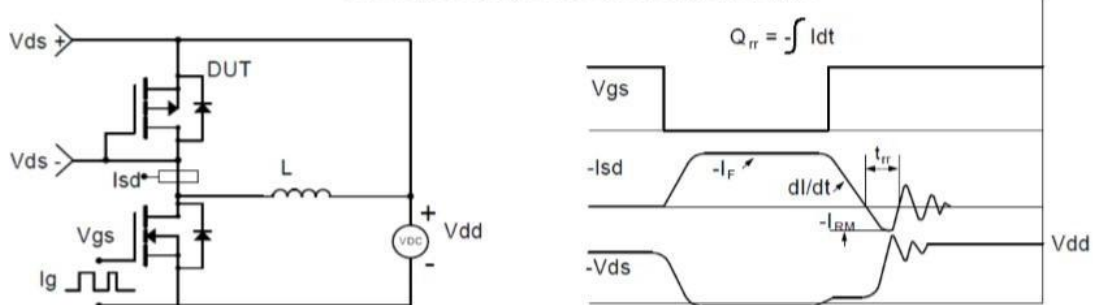
Resistive Switching Test Circuit & Waveforms



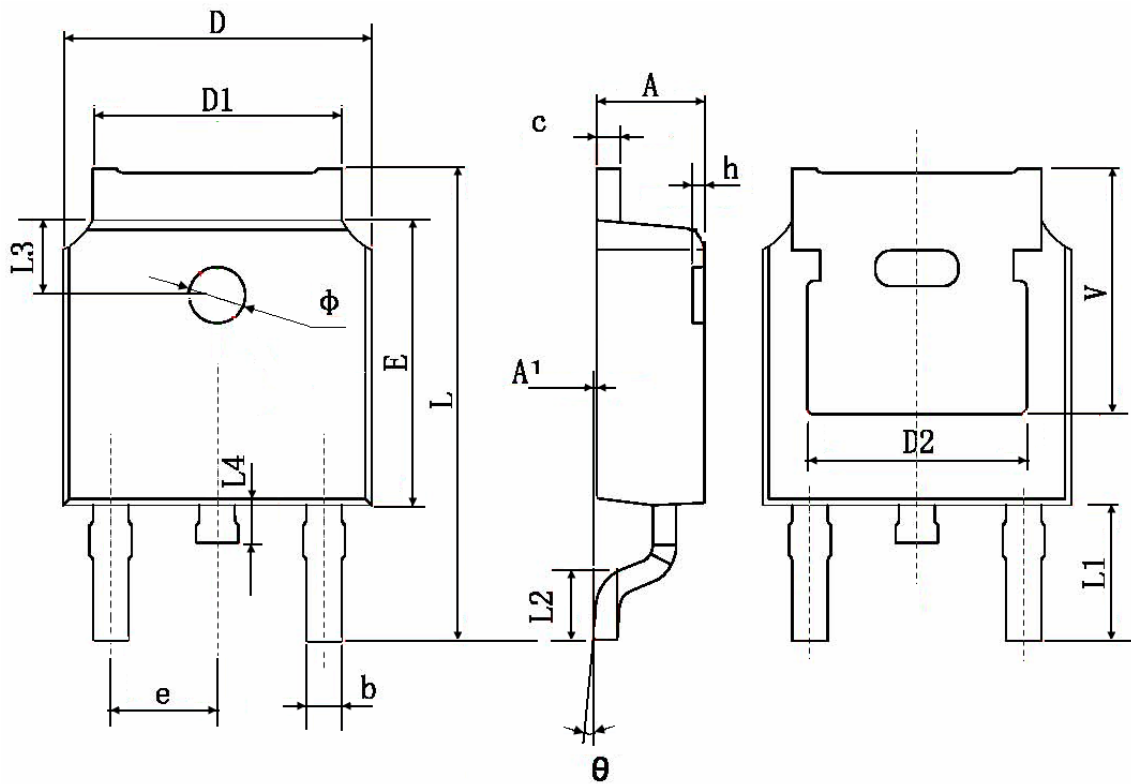
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Package Mechanical Data: TO-252-3L



| 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 | 4.830 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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