

**TMP2070D**

**P -Channel Enhancement Mosfet**

**General Description**

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

**Applications**

- Load switch
- PWM

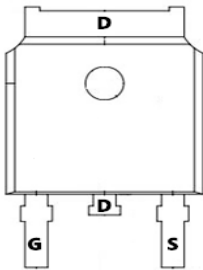
**General Features**

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

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

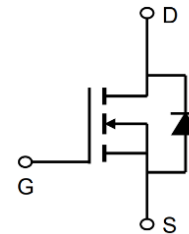
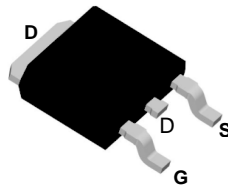
100% UIS Tested

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	$\pm 12$	V
$I_D$	Continuous Drain Current	$T_C = 25^\circ C$	-70
		$T_C = 100^\circ C$	-39
$I_{DM}$	Pulsed Drain Current <sup>note1</sup>	-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	$^\circ C$

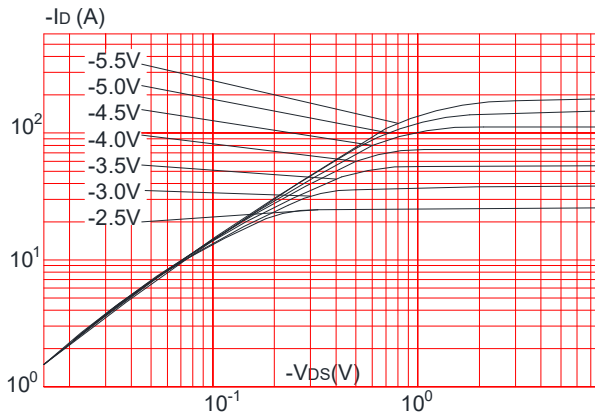
**Electrical Characteristics** ( $T_J=25^\circ\text{C}$  unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
<b>Off Characteristic</b>						
$V_{(BR)DSS}$	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	$\mu A$
$I_{GSS}$	Gate to Body Leakage Current	$V_{DS} = 0V, V_{GS} = \pm 12V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	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 $\Omega$
		$V_{GS} = -2.5V, I_D = -12A$	-	8	12	
<b>Dynamic Characteristics</b>						
$C_{iss}$	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
<b>Switching Characteristics</b>						
$t_{d(on)}$	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
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	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

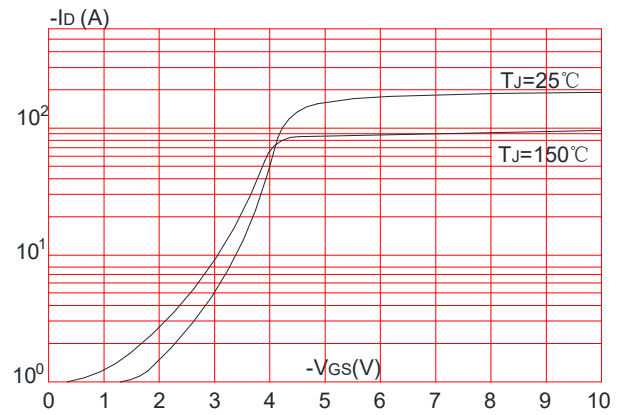
- Notes: 1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature  
 2. EAS condition:  $T_J = 25^\circ\text{C}, V_{DD} = -10V, V_G = -10V, R_G = 5.9\Omega, L = 0.5\text{mh}, I_{AS} = -13.2A$   
 3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 0.5\%$

## Typical Performance Characteristics

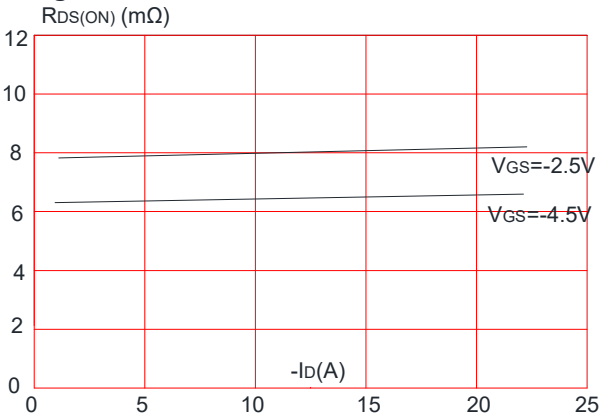
**Figure 1: Output Characteristics**



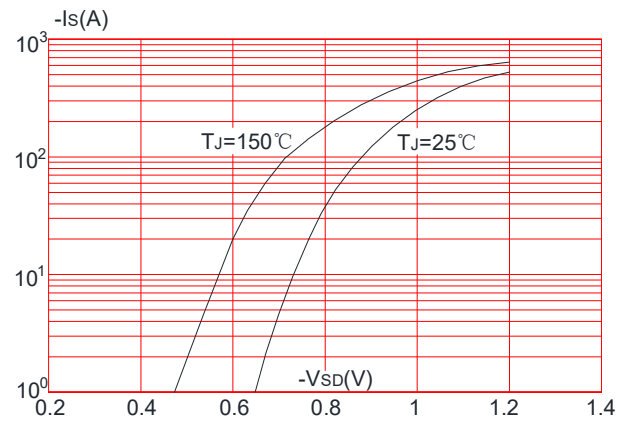
**Figure 2: Typical Transfer Characteristics**



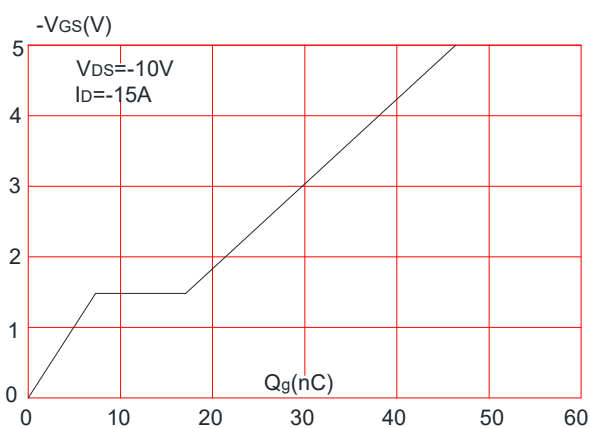
**Figure 3: On-resistance vs. Drain Current**



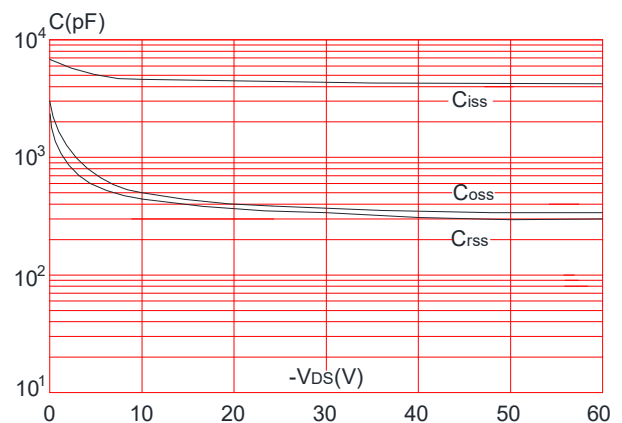
**Figure 4: Body Diode Characteristics**



**Figure 5: Gate Charge Characteristics**



**Figure 6: Capacitance Characteristics**



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Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

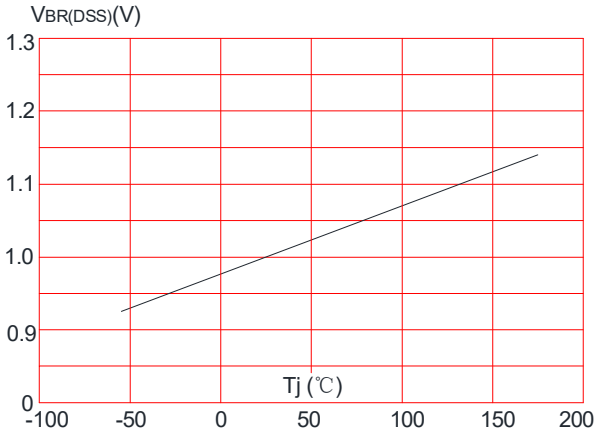


Figure 8: Normalized on Resistance vs. Junction Temperature

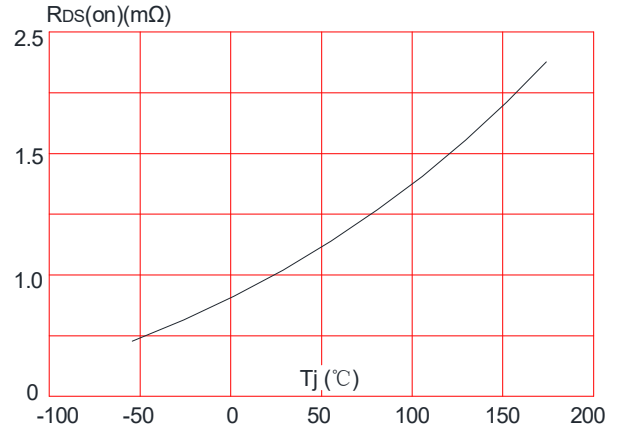


Figure 9: Maximum Safe Operating Area

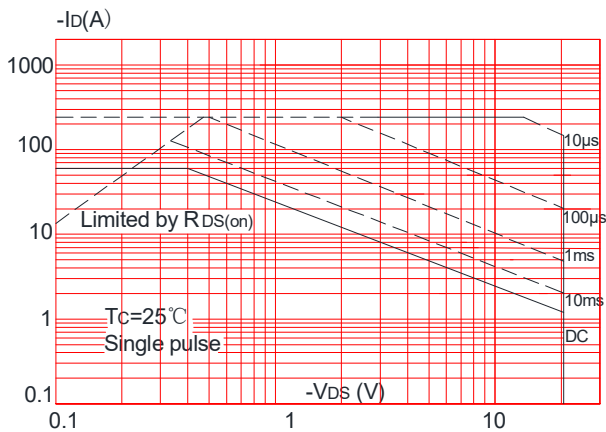


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

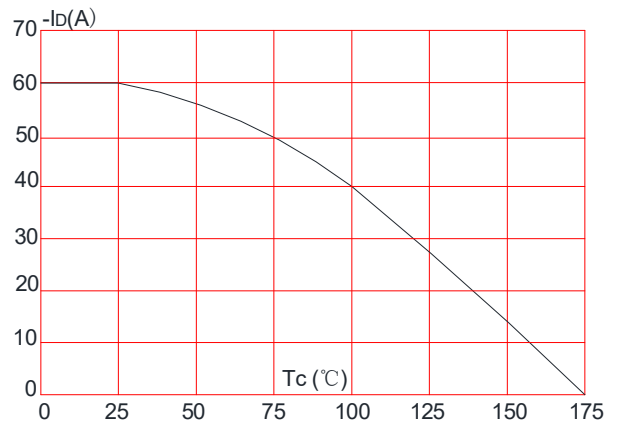
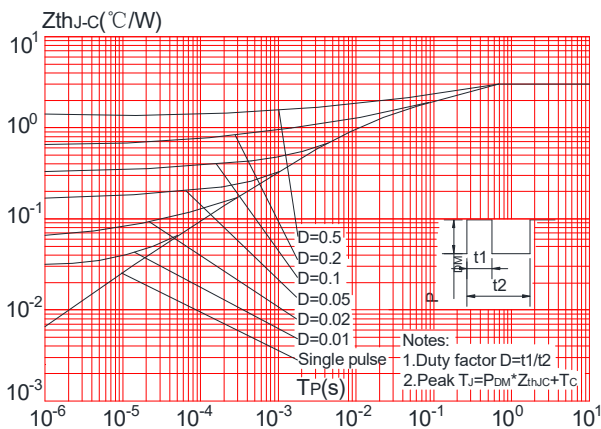
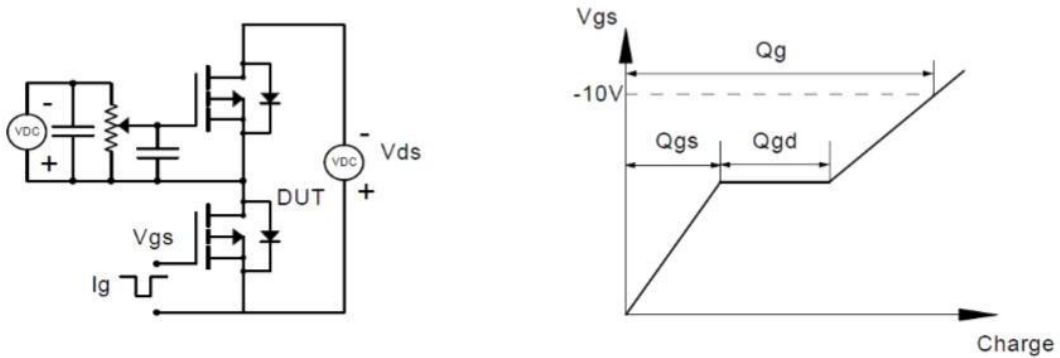


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case

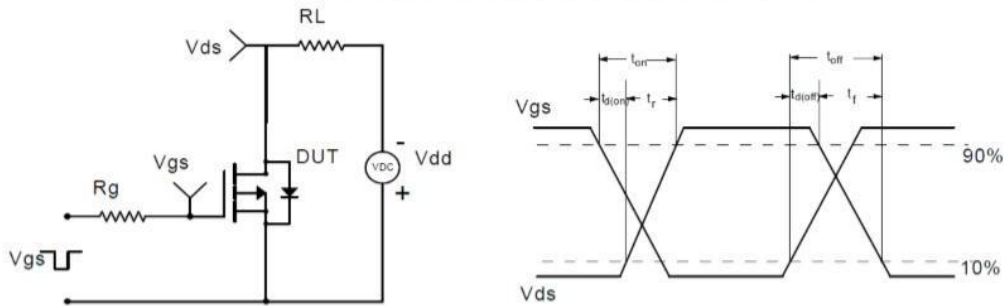


**Test Circuit**

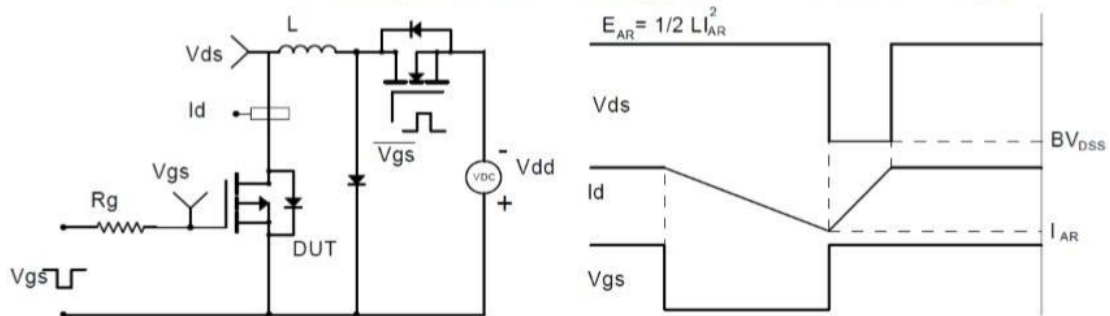
Gate Charge Test Circuit & Waveform



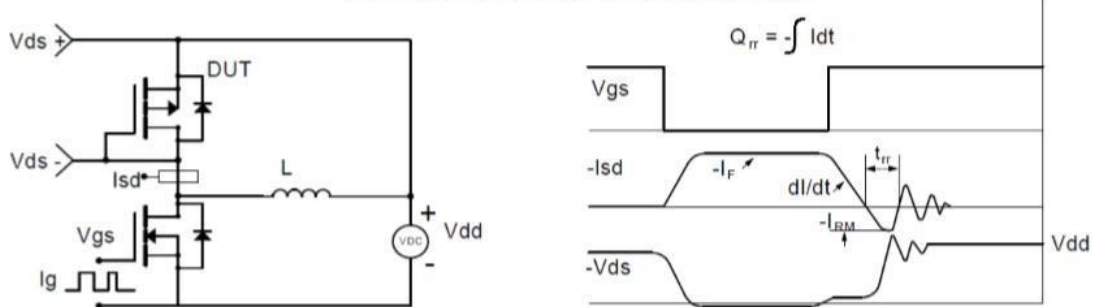
Resistive Switching Test Circuit & Waveforms



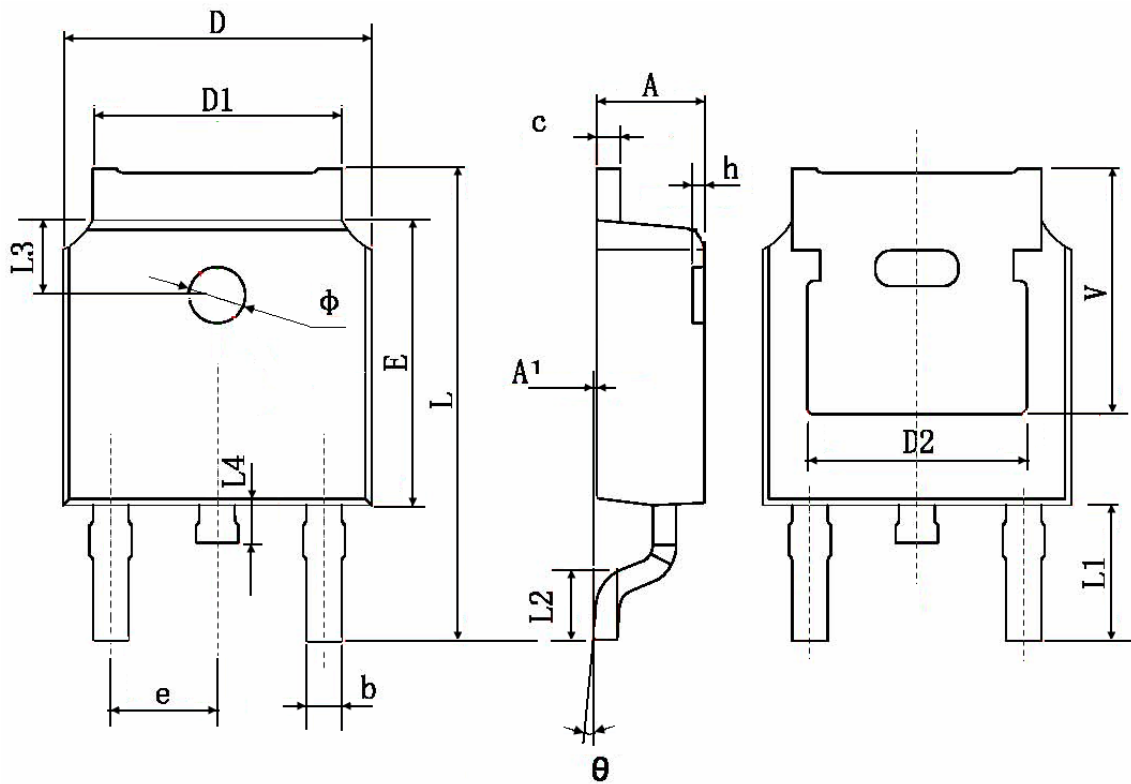
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



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.	