



TM70P02DF

P -Channel Enhancement Mosfet

General Description

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

Applications

- Load switch
- PWM

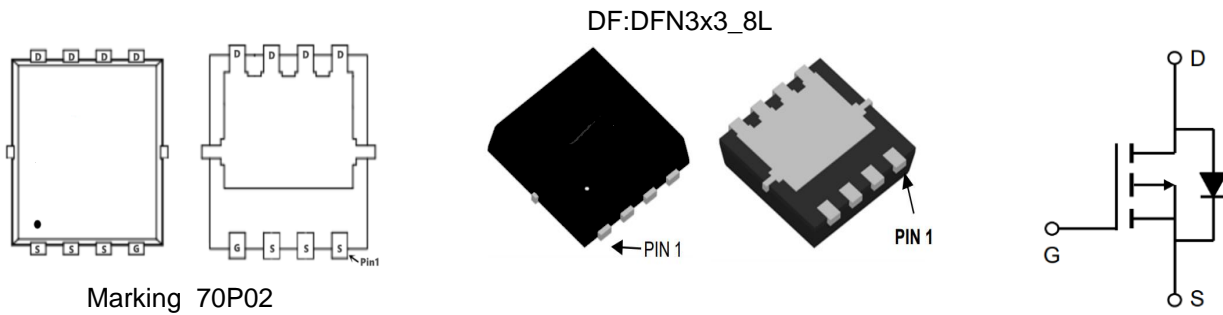
General Features

$V_{DS} = -20V$ $I_D = -60A$

$R_{DS(ON)} = 6.6 m\Omega (typ.) @ V_{GS} = -4.5V$

100% UIS Tested

100% R_g Tested



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

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	-20	V
V_{GS}	Gate-Source Voltage	± 12	V
$I_D @ T_C=25^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V^1$	-60	A
$I_D @ T_C=70^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V^1$	-38	A
I_{DM}	Pulsed Drain Current ²	-220	A
$P_D @ T_C=25^\circ C$	Total Power Dissipation ³	42	W
T_{STG}	Storage Temperature Range	-55 to 150	$^\circ C$
T_J	Operating Junction Temperature Range	-55 to 150	$^\circ C$

Thermal Data

Symbol	Parameter	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction Ambient ¹	75	$^\circ C/W$

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	-1.0	-1.5	V
$R_{DS(on)}$	Static Drain-Source on-Resistance <small>note3</small>	$V_{GS} = -4.5V, I_D = -15A$	-	6.6	8.5	m Ω
		$V_{GS} = -2.5V, I_D = -12A$	-	8	12	
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = -10V, V_{GS} = 0V,$ $f = 1.0MHz$	-	4600	-	pF
C_{oss}	Output Capacitance		-	460	-	pF
C_{rss}	Reverse Transfer Capacitance		-	459	-	pF
Q_g	Total Gate Charge	$V_{DS} = -10V, I_D = -15A,$ $V_{GS} = -4.5V$	-	56	-	nC
Q_{gs}	Gate-Source Charge		-	8	-	nC
Q_{gd}	Gate-Drain("Miller") Charge		-	16	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = -10V, I_D = -13A,$ $R_{GEN} = 2.7\Omega, V_{GS} = -10V$	-	11	-	ns
t_r	Turn-on Rise Time		-	110	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	157	-	ns
t_f	Turn-off Fall Time		-	160	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	-60	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-220	A
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0V, I_S = -30A$	-	-	-1.2	V
t_{rr}	Reverse Recovery Time	$T_J = 25^\circ\text{C}, I_{SD} = -15A,$ $V_{GS} = 0V$ $di/dt = -100A/\mu s$	-	23	-	ns
Q_{rr}	Reverse Recovery Charge		-	14	-	Nc

- Notes: 1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
 2. EAS condition: $T_J = 25^\circ\text{C}, V_{DD} = -10V, V_G = -10V, R_G = 5.9\Omega, L = 0.5\text{mh}, I_{AS} = -16A$
 3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 0.5\%$



Typical Performance Characteristics

Figure 1: Output Characteristics

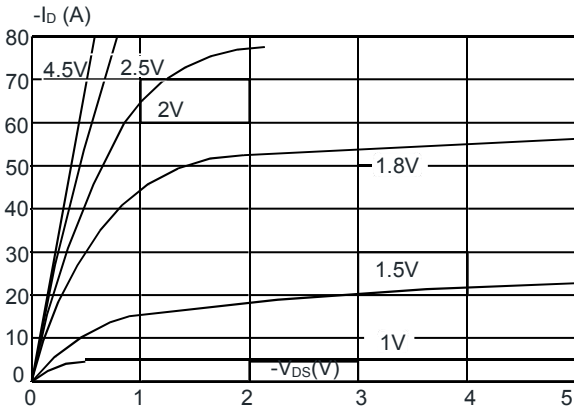


Figure 2: Typical Transfer Characteristics

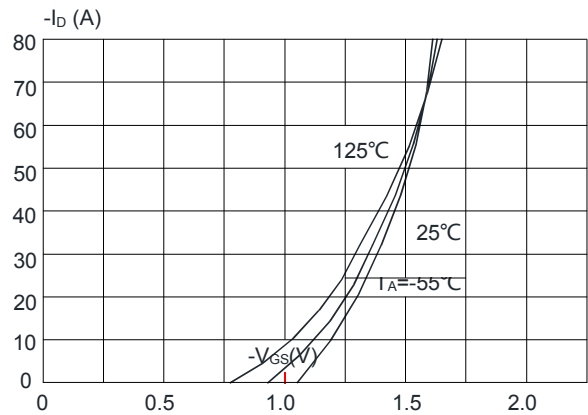


Figure 3: On-resistance vs. Drain Current

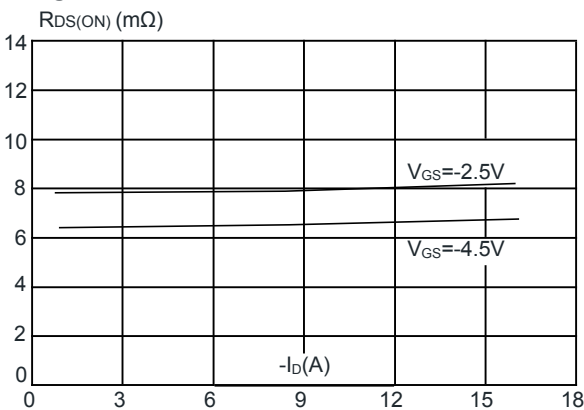


Figure 4: Body Diode Characteristics

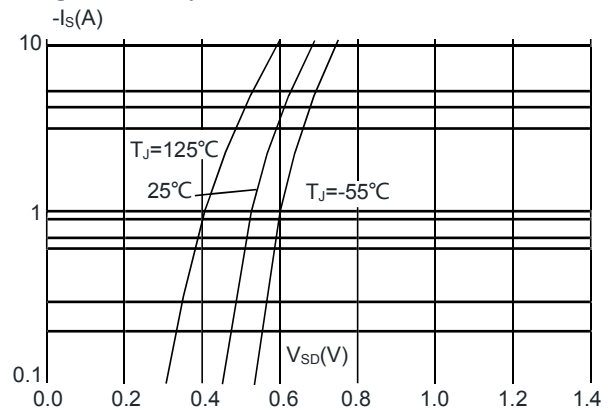


Figure 5: Gate Charge Characteristics

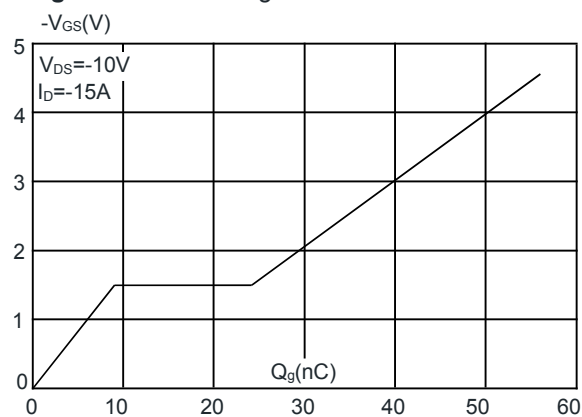
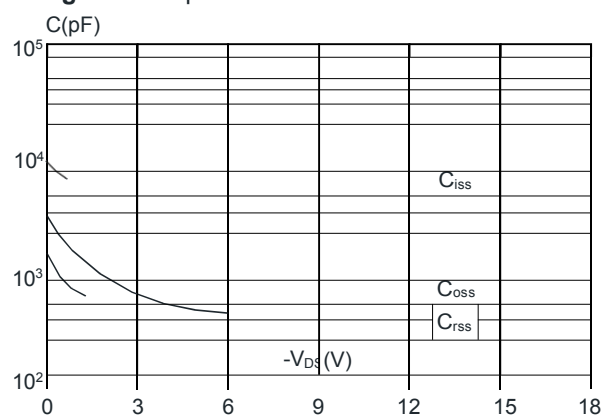


Figure 6: Capacitance Characteristics



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Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

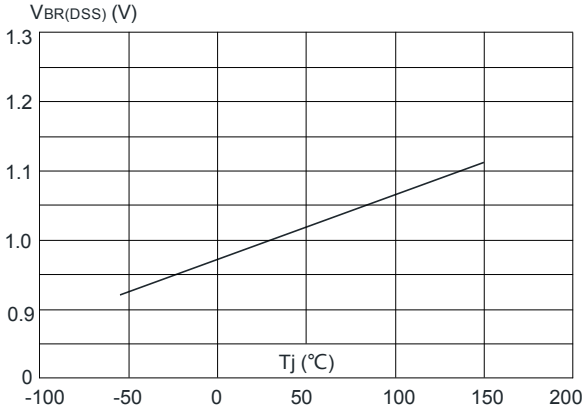


Figure 8: Normalized on Resistance vs. Junction Temperature

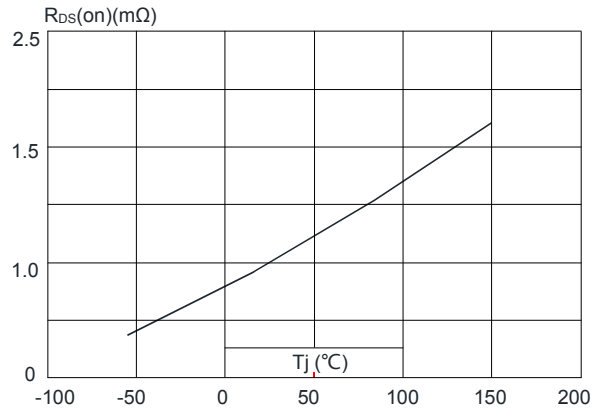


Figure 9: Maximum Safe Operating Area

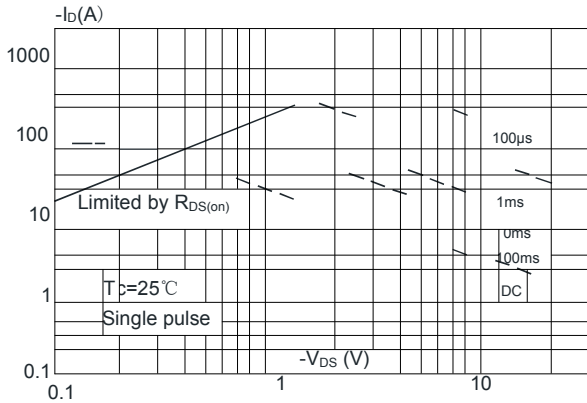


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

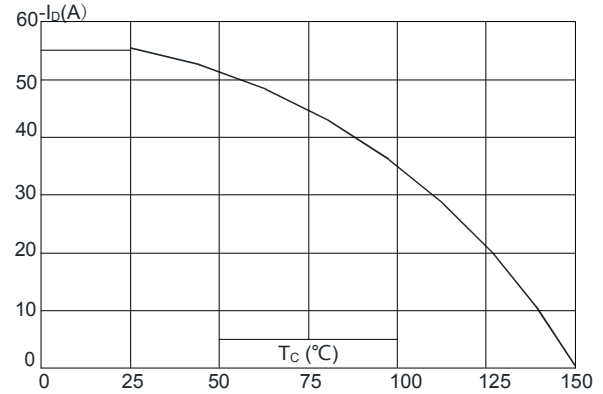
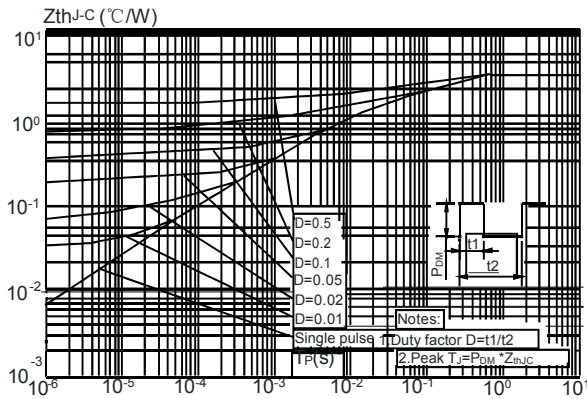
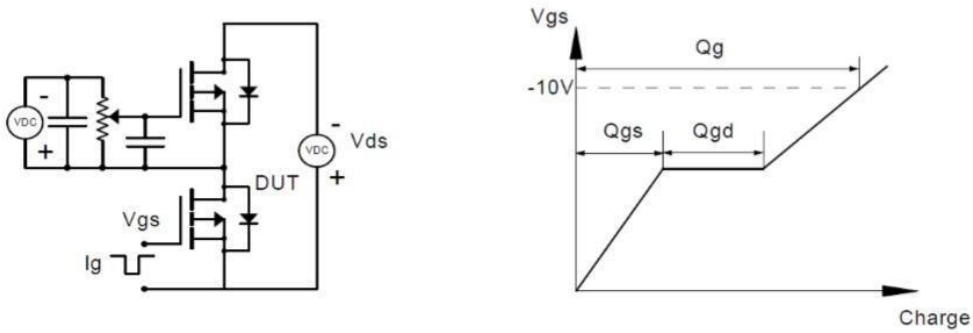


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case

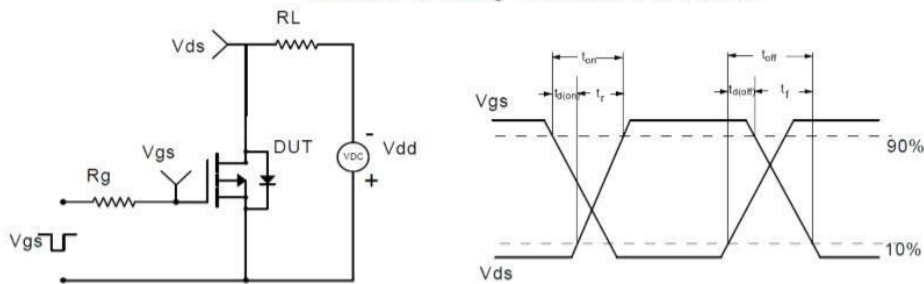


Test Circuit

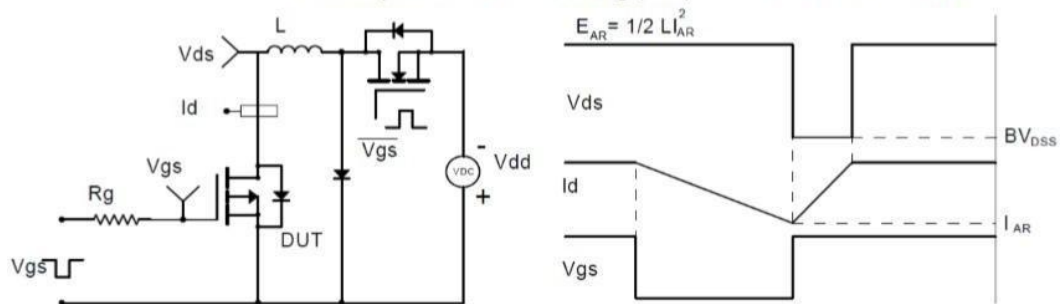
Gate Charge Test Circuit & Waveform



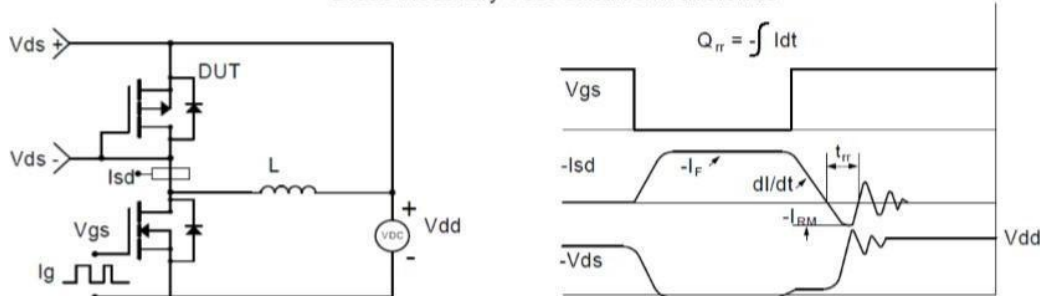
Resistive Switching Test Circuit & Waveforms



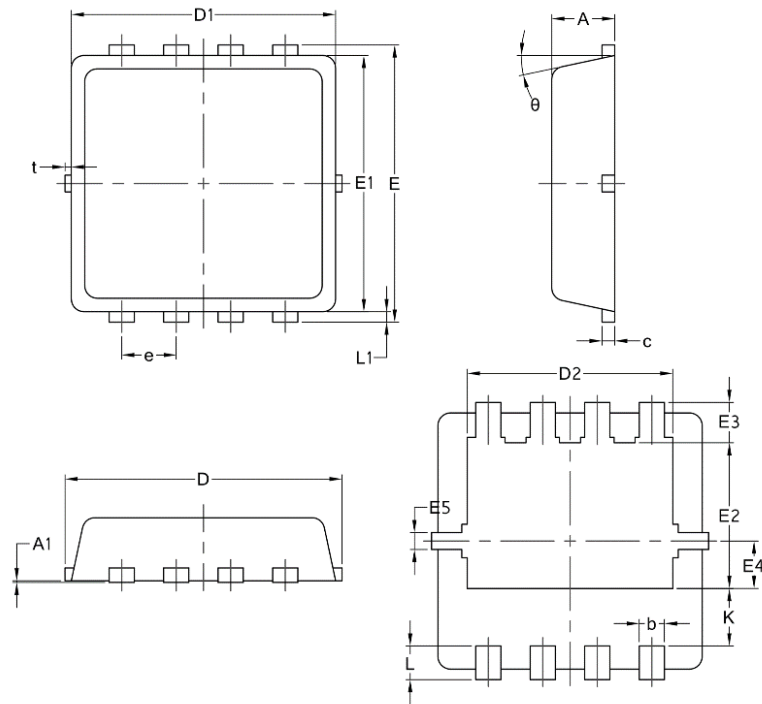
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Package Mechanical Data:DFN3x3-8L



Symbol	Common		
	mm		
	Mim	Nom	Max
A	0.70	0.75	0.85
A1	/	/	0.05
b	0.20	0.30	0.40
c	0.10	0.152	0.25
D	3.15	3.30	3.45
D1	3.00	3.15	3.25
D2	2.29	2.45	2.65
E	3.15	3.30	3.45
E1	2.90	3.05	3.20
E2	1.54	1.74	1.94
E3	0.28	0.48	0.65
E4	0.37	0.57	0.77
E5	0.10	0.20	0.30
e	0.60	0.65	0.70
K	0.59	0.69	0.89
L	0.30	0.40	0.50
L1	0.06	0.125	0.20
t	0	0.075	0.13
Φ	10	12	14

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