

N-Ch and P-Ch Power MOSFET

Description

Complementary Enhancement MOSFET in a TO-252-4L Package. The SFQ0420T4 uses advanced trench technology and design to provide excellent $R_{DS(on)}$ with low gate charge can be used in a wide variety of applications

Features

N-CHANNEL

- ◆ $V_{DS}=40V, I_D=21A$
- ◆ $R_{DS(on)}$
TYP: $14m\Omega @ V_{GS}=10V$
TYP: $19m\Omega @ V_{GS}=4.5V$

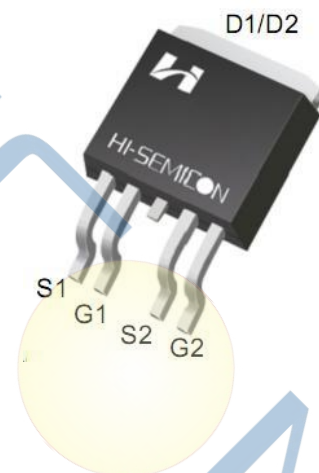
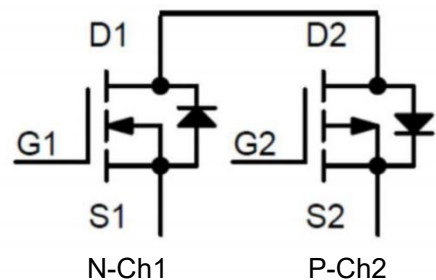
P-CHANNEL

- ◆ $V_{DS}=-40V, I_D=-15A$
- ◆ $R_{DS(on)}$
TYP: $25m\Omega @ V_{GS}=-10V$
TYP: $32m\Omega @ V_{GS}=-4.5V$

Applications

- ◆ H-bridge
- ◆ Inverters

100% DVDS Tested
100% Avalanche Tested



Ordering Information

Part No.	Package	Marking	Material	Packing
SFQ0420T4	TO-252-4L	SFQ0420T4	Pb Free	Reel



Absolute Maximum Ratings (T_J=25°C unless otherwise noted)

Characteristics		Symbol	N-Ch	P-Ch	Unit
Drain-Source Voltage		V _{DS}	40	-40	V
Gate-Source Voltage		V _{GS}	±20	±20	V
Drain Current	T _C = 25°C	I _D	21	-15	A
	T _C = 100°C		13.7	9.8	
Drain Current Pulsed(Note 1)		I _{DM}	84	-60	A
Power Dissipation(T _C =25°C)		P _D	40		W
Single Pulsed Avalanche Energy (Note 2)		E _{AS}	36	81	mJ
Operation Junction Temperature Range		T _J	-55~+150		°C
Storage Temperature Range		T _{stg}	-55~+150		°C
Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		TL	300		°C

Thermal Charac Teristics

Characteristics	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	R _{θJC}	3.1	°C/W
Thermal Resistance, Junction-to-Ambient	R _{θJA}	70	°C/W

N-Ch Electrical Characteristics

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
Drain -Source Breakdown Voltage	B _{VDSS}	V _{GS} =0V, I _D =250μA	40	49	--	V
Drain-Source Leakage Current	I _{DSS}	V _{DS} =40V, V _{GS} =0V	--	--	1.0	uA
Gate-Source Leakage Current	I _{GSS}	V _{GS} =20V, V _{DS} =0V	--	--	100	nA
Gate-Source Leakage Current	I _{GSS}	V _{GS} =-20V, V _{DS} =0V	--	--	-100	
On Characteristics						
Gate Threshold Voltage	V _{GS(th)}	V _{GS} = V _{DS} , I _D =250μA	1.3	1.5	1.8	V
Static Drain- Source On State Resistance	R _{DS(on)}	V _{GS} =10V, I _D =10A	--	14	19	mΩ
		V _{GS} =4.5V, I _D =5A	--	19	28	
Transconductance	g _{FS}	V _{DS} =10V, I _D =5A	--	10	--	S
Dynamic Characteristics						
Gate Resistance	R _g	V _{GS} =0V; f=1.0MHZ	--	4.2	--	Ω
Input Capacitance	C _{iss}	V _{DS} =20V V _{GS} =0V f=1.0MHZ	--	712	--	pF
Output Capacitance	C _{oss}		--	53	--	
Reverse Transfer Capacitance	C _{rss}		--	47	--	
Switching Characteristics						
Turn-on Delay Time	t _{d(on)}	V _{DD} =20V R _G =3Ω; I _D =10A V _{GS} =10V (Note 3.4)	--	4.2	--	ns
Turn-on Rise Time	t _r		--	11.1	--	
Turn-off Delay Time	t _{d(off)}		--	19.2	--	
Turn-off Fall Time	t _f		--	6.1	--	
Total Gate Charge	Q _g	V _{DS} =20V, I _D =10A V _{GS} =10V (Note 3.4)	--	30.4	--	nc
Gate-Source Charge	Q _{gs}		--	4.8	--	
Gate-Drain Charge	Q _{gd}		--	7.2	--	

N-Ch Source-drain diode ratings and characteristics

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Continuous Source Current	I_S	Integral Reverse P-N Junction Diode in the MOSFET	--	--	21	A
Pulsed Source Current	I_{SM}		--	--	84	
Diode Forward Voltage	V_{SD}	$I_S=10A, V_{GS}=0V$	--	0.88	1.2	V
Reverse Recovery Time	T_{rr}	$I_F=10A,$ $dI_F/dt=100A/\mu S$	--	22	--	ns
Reverse Recovery Charge	Q_{rr}		--	21	--	nC

- 1) Pluse width limited by maximum junction temperature.
- 2) $L=0.5mH$, $I_{AS}=13A$, $V_{DD}=20V$, $V_G=10V$, $R_G=25\Omega$, starting $T_J=25^\circ C$.
- 3) Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.
- 4) Essentially independent of operating temperature.

N-Ch Typical performance characteristics

Figure 1 Output Characteristics

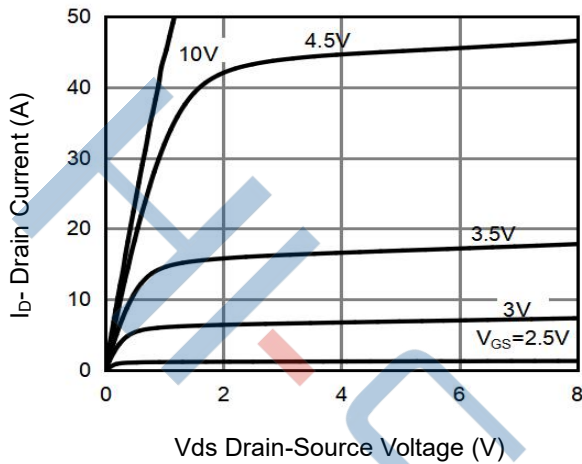


Figure 2 Transfer Characteristics

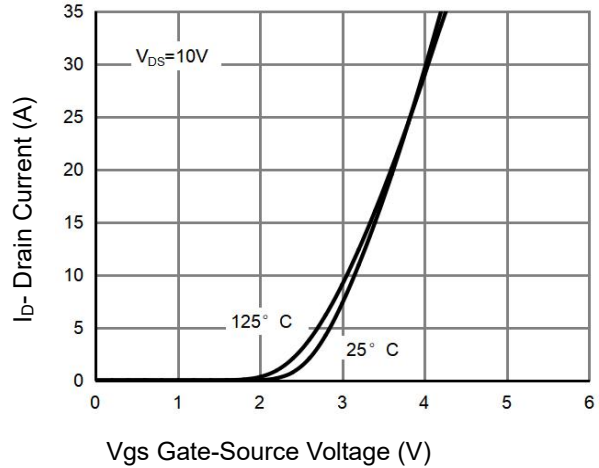


Figure 3 Drain-Source On-Resistance

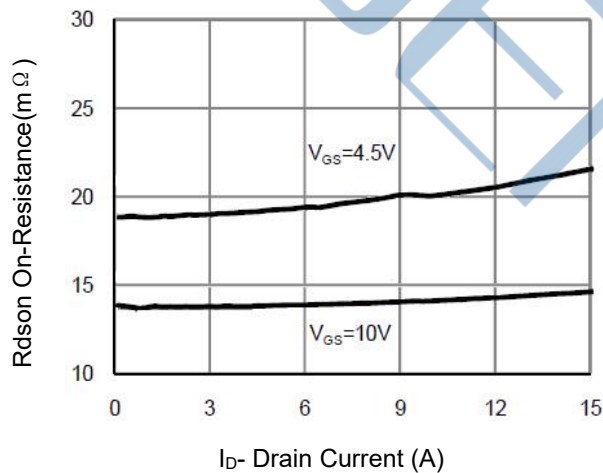


Figure 4 Drain-Source On-Resistance

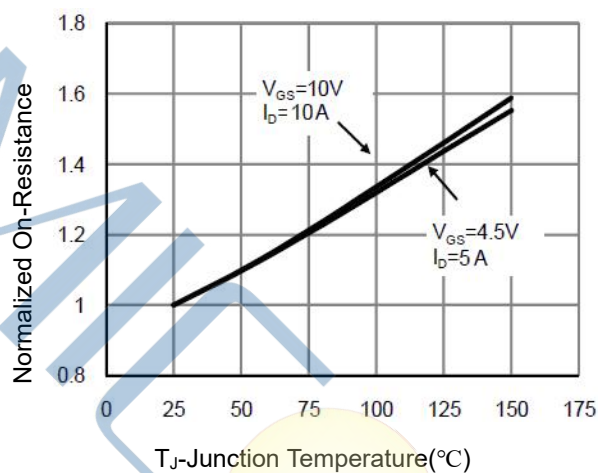


Figure 5 Rdson vs Vgs

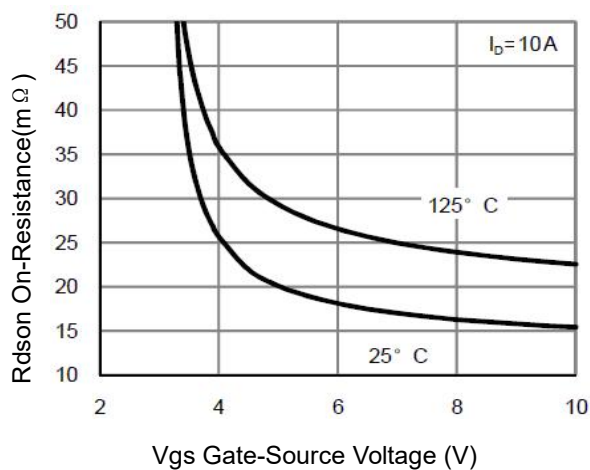
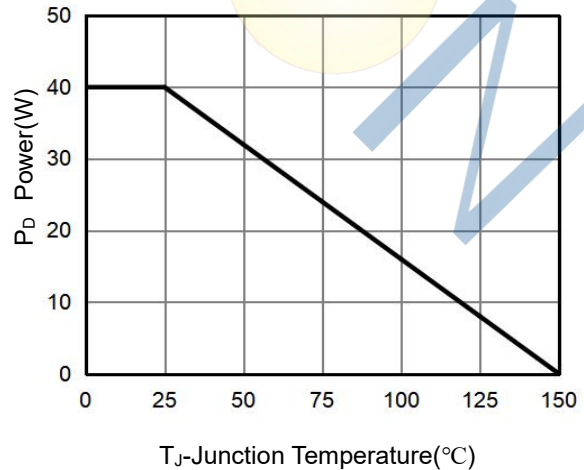


Figure 6 Power Dissipation



N-Ch Typical performance characteristics

Figure 7 Gate Charge

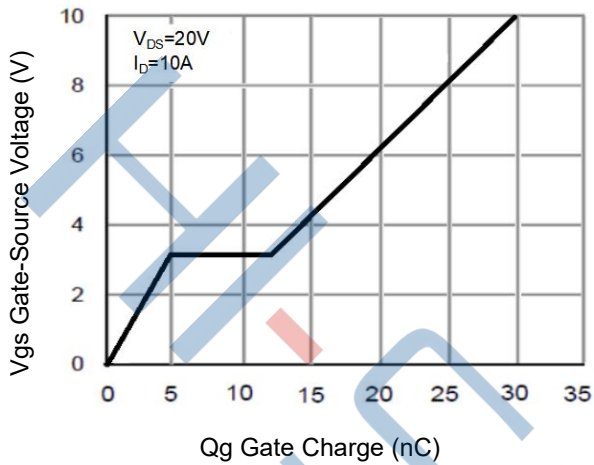


Figure 8 Source- Drain Diode Forward

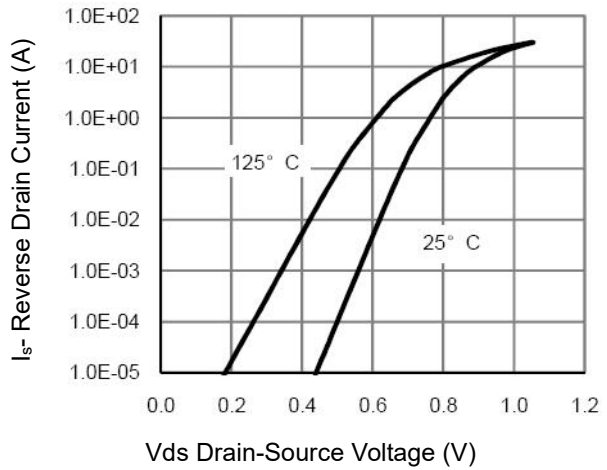


Figure 9 Capacitance vs Vds

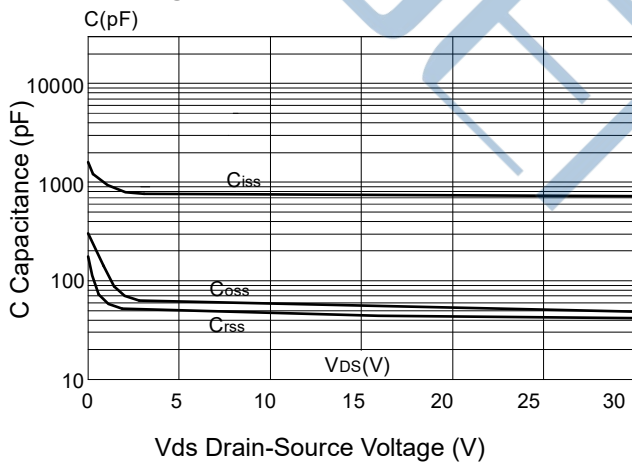
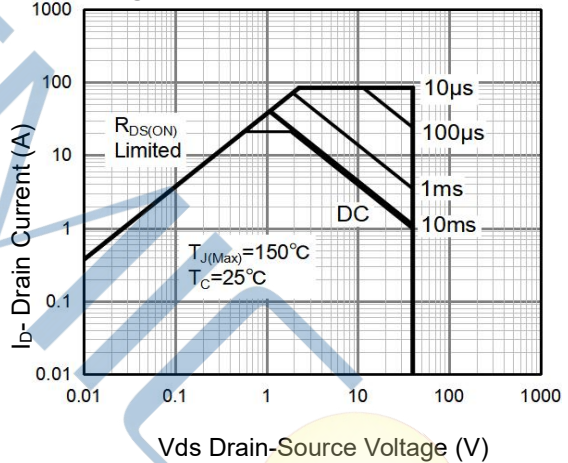
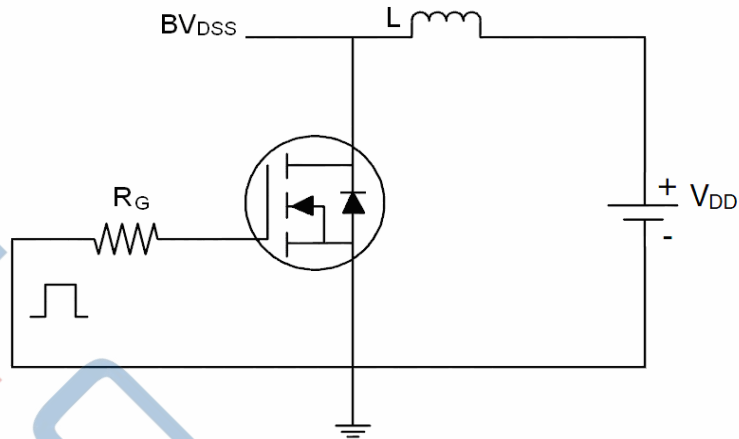


Figure 10 Safe Operation Area

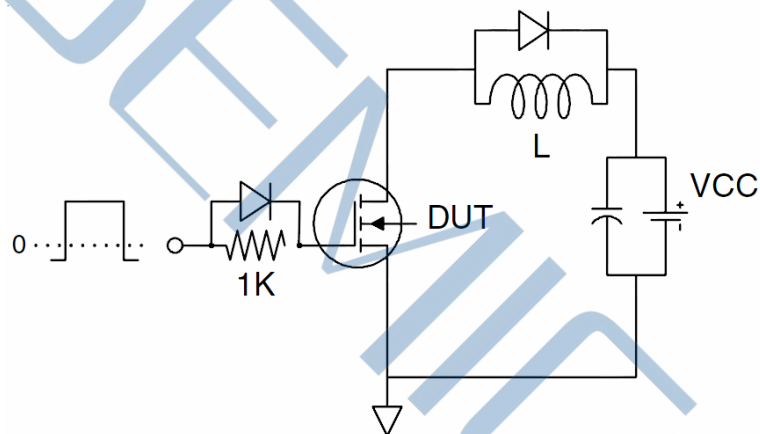


N-Ch Test Circuit

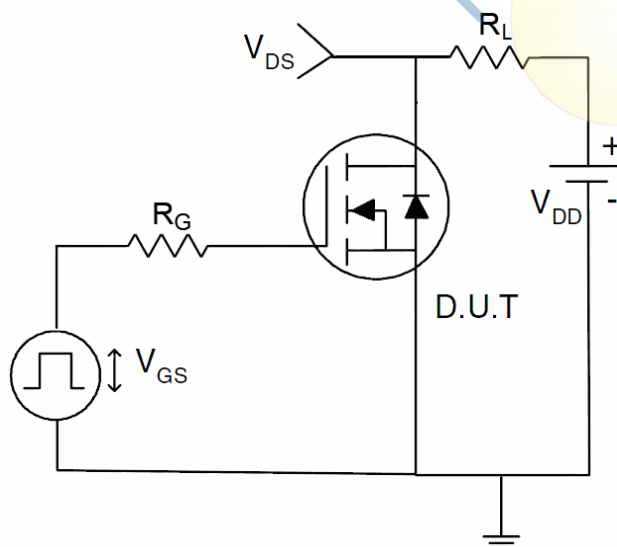
1) E_{AS} test Circuits



2) Gate charge test Circuit:



3) Switch Time Test Circuit:



P-Ch Electrical Characteristics

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
Drain -Source Breakdown Voltage	B _{VDSS}	V _{GS} =0V, I _D =-250μA	-40	-46	--	V
Drain-Source Leakage Current	I _{DSS}	V _{DS} =-40V, V _{GS} =0V	--	--	-1.0	uA
Gate-Source Leakage Current	I _{GSS}	V _{GS} =20V, V _{DS} =0V	--	--	100	nA
Gate-Source Leakage Current	I _{GSS}	V _{GS} =-20V, V _{DS} =0V	--	--	-100	
On Characteristics						
Gate Threshold Voltage	V _{GS(th)}	V _{GS} = V _{DS} , I _D =-250μA	-1.3	-1.6	-2.0	V
Static Drain- Source On State Resistance	R _{DS(on)}	V _{GS} =-10V, I _D =-10A	--	25	35	mΩ
		V _{GS} =-4.5V, I _D =-5A	--	32	45	mΩ
Transconductance	g _{FS}	V _{DS} =-10V, I _D =-5A	--	12	--	S
Dynamic Characteristics						
Gate Resistance	R _g	V _{GS} =0V; f=1.0MHZ	--	7.3	--	Ω
Input Capacitance	C _{iss}	V _{DS} =-20V	--	1340	--	pF
Output Capacitance	C _{oss}	V _{GS} =0V	--	110	--	
Reverse Transfer Capacitance	C _{rss}	f=1.0MHZ	--	91	--	
Switching Characteristics						
Turn-on Delay Time	t _{d(on)}	V _{DD} =-20V	--	11.5	--	ns
Turn-on Rise Time	t _r	R _G =3Ω; I _D =-8A	--	15.8	--	
Turn-off Delay Time	t _{d(off)}	V _{GS} =-10V	--	32.3	--	
Turn-off Fall Time	t _f	(Note 3.4)	--	20.8	--	
Total Gate Charge	Q _g	V _{DS} =-20V, I _D =-8A	--	22.2	--	nC
Gate-Source Charge	Q _{gs}	V _{GS} =10V	--	2.5	--	
Gate-Drain Charge	Q _{gd}	(Note 3.4)	--	5.0	--	

P-Ch Source-drain diode ratings and characteristics

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Continuous Source Current	I_S	Integral Reverse P-N Junction Diode in the MOSFET	--	--	-15	A
Pulsed Source Current	I_{SM}		--	--	-60	
Diode Forward Voltage	V_{SD}	$I_S=-10A, V_{GS}=0V$	--	-0.93	-1.2	V
Reverse Recovery Time	T_{rr}	$I_F=-10A,$ $dI_F/dt=100A/\mu S$	--	34	--	ns
Reverse Recovery Charge	Q_{rr}		--	59	--	nC

- 5) Pulse width limited by maximum junction temperature.
- 6) $L=0.5mH$, $I_{AS}=-19A$, $V_{DD}=-30V$, $V_G=-10V$, $R_G=25\Omega$, starting $T_J=25^\circ C$.
- 7) Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.
- 8) Essentially independent of operating temperature.

P-Ch Typical performance characteristics

Figure 1 Output Characteristics

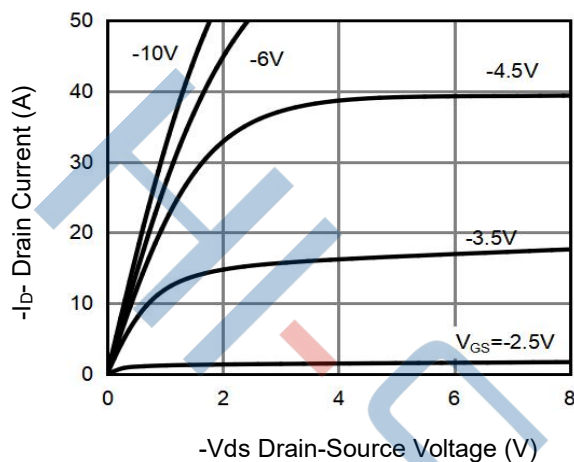


Figure 2 Transfer Characteristics

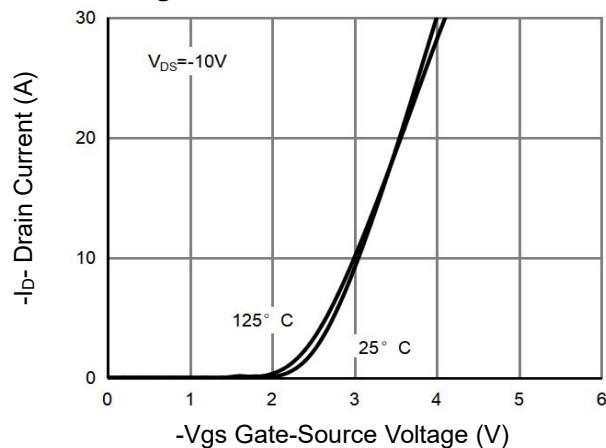


Figure 3 Rdson- Drain Current

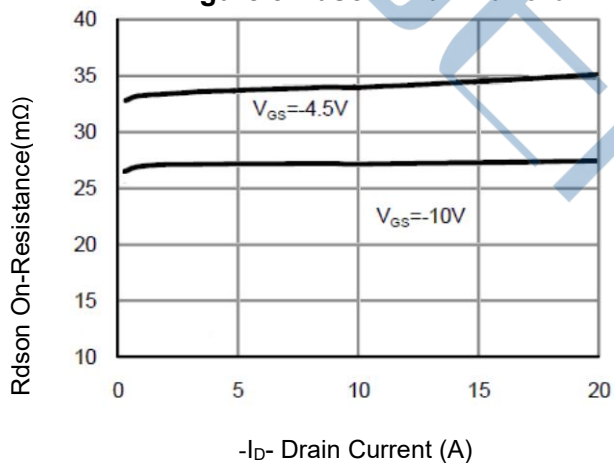


Figure 4 Rdson-Junction Temperature

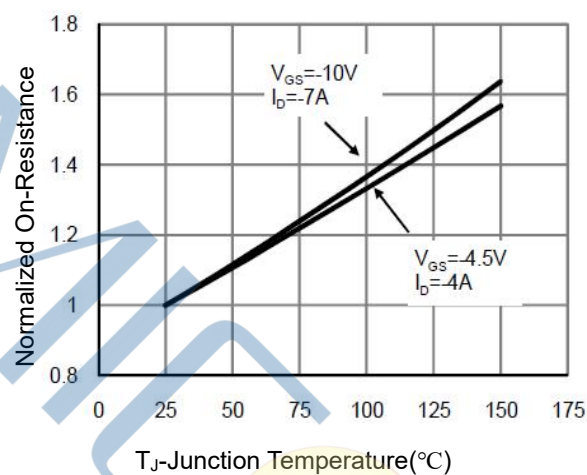


Figure 5 Gate Charge

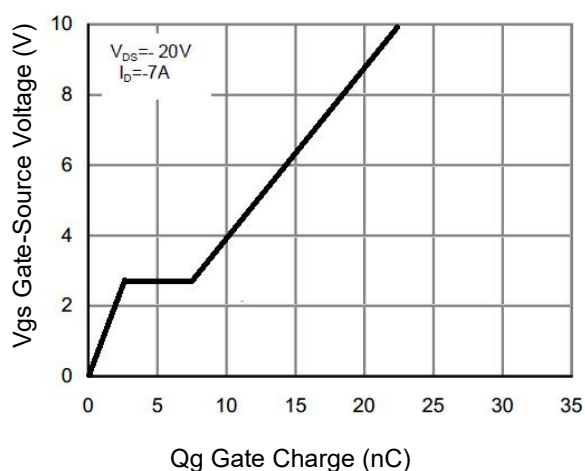
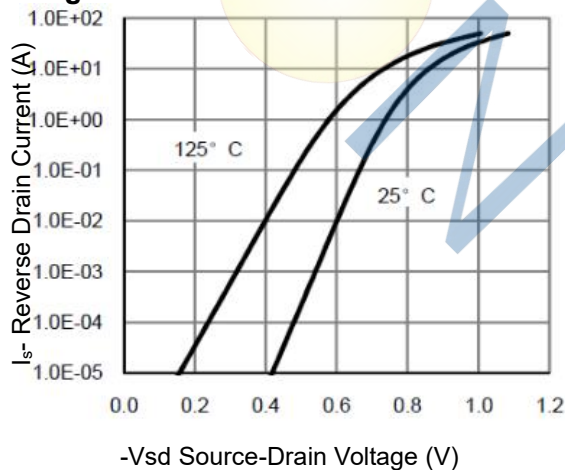


Figure 6 Source- Drain Diode Forward



P-Ch Typical performance characteristics

Figure 7 Capacitance vs Vds

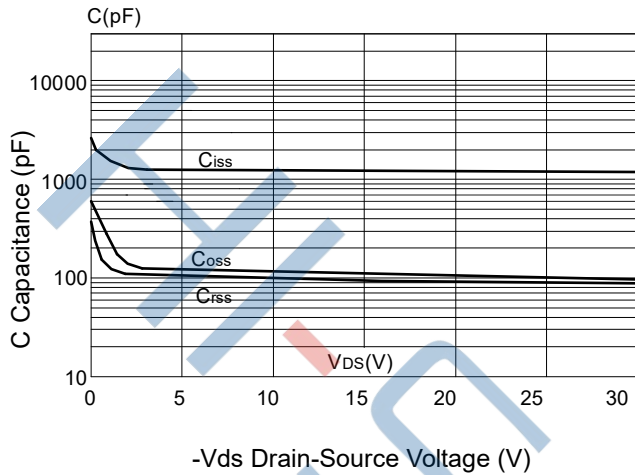


Figure 8 Power Dissipation

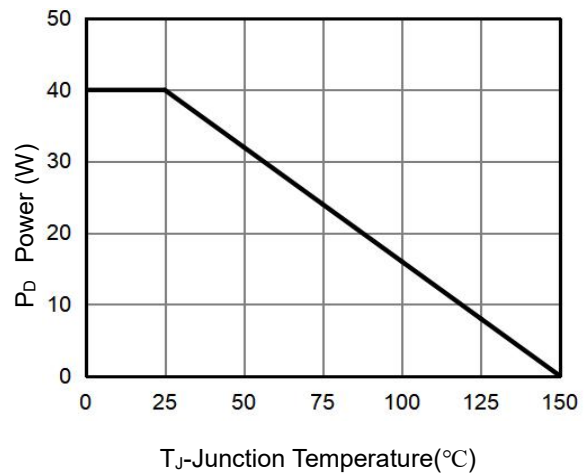


Figure 9 Safe Operation Area

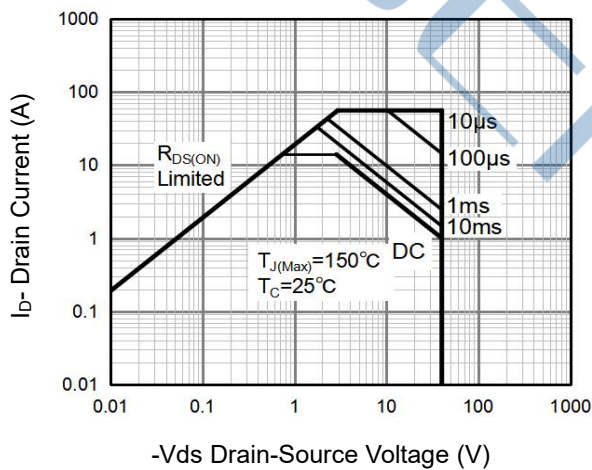
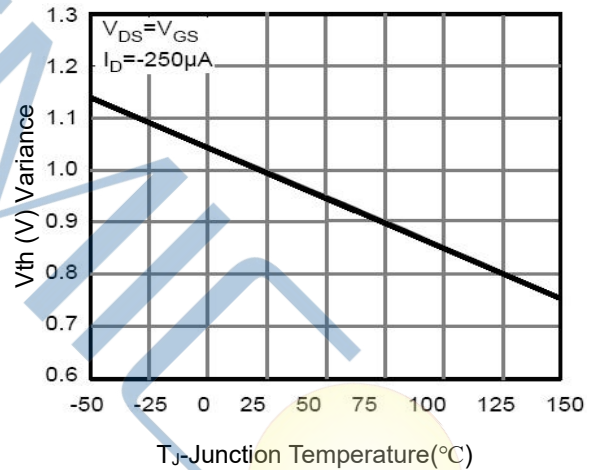
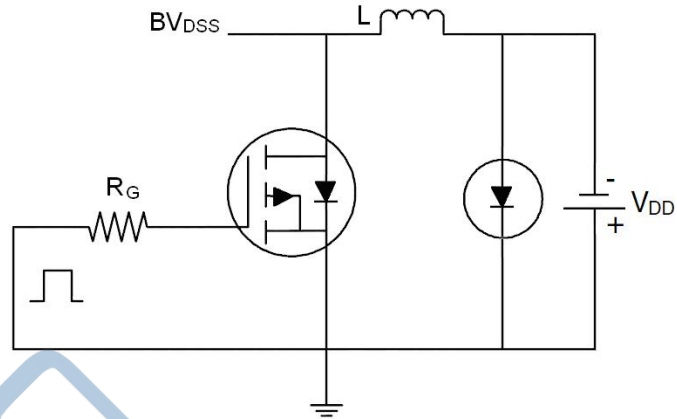


Figure 10 $V_{GS(th)}$ vs Junction Temperature

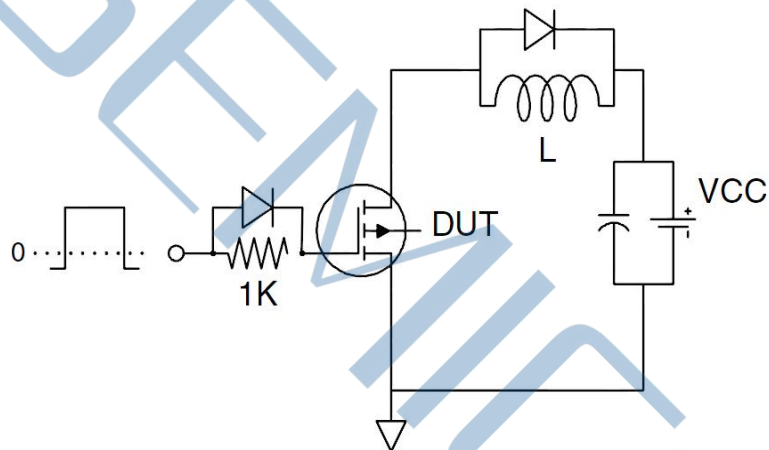


P-Ch Test Circuit

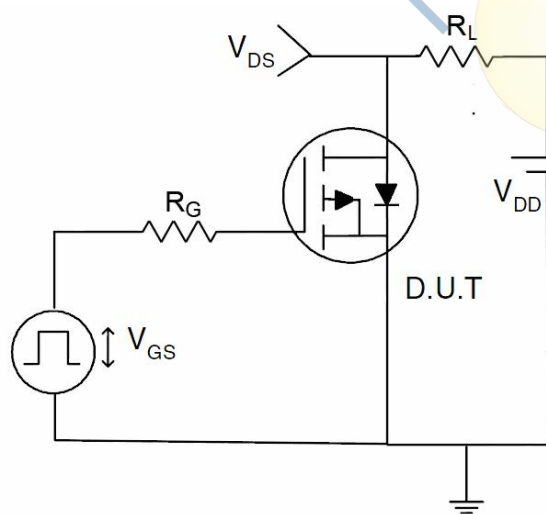
1) E_{AS} Test Circuit



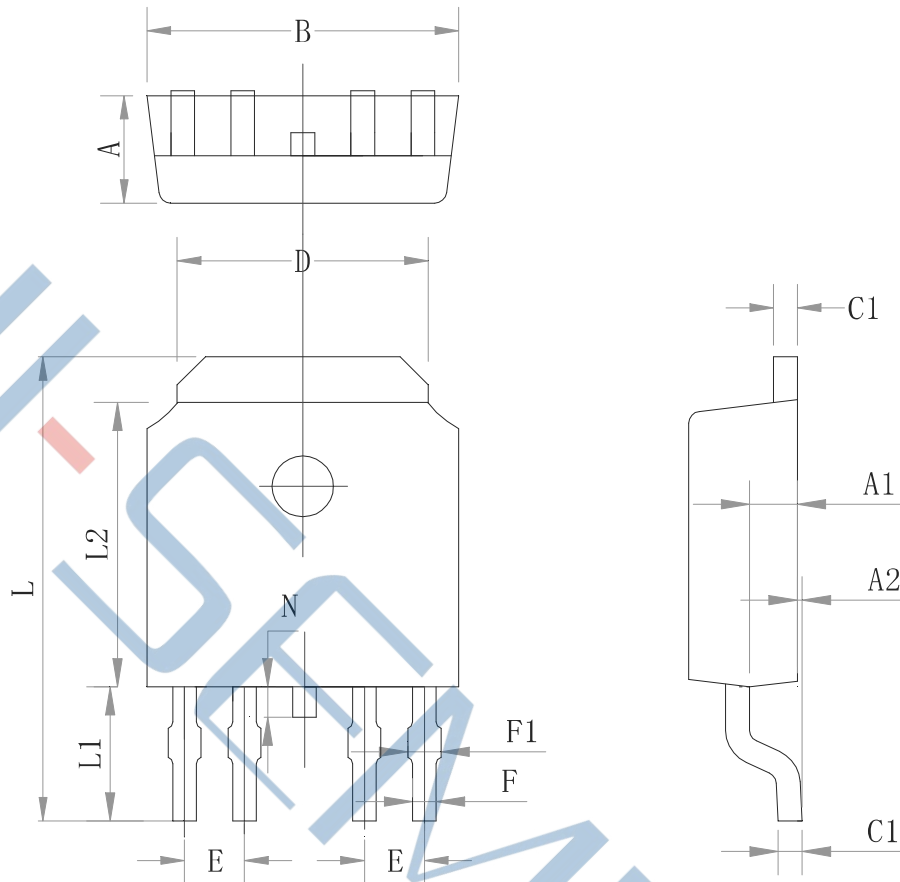
2) Gate Charge Test Circuit



3) Switch Time Test Circuit



Package dimensions of TO-252-4L



Unit:mm

Symbol	Min	Typ	Max
A	2.22	2.30	2.38
A1	0.93	1.01	1.08
A2	0.05	0.15	0.20
B	6.52	6.60	6.68
C	0.48	0.50	0.54
C1	0.48	0.50	0.54
D	5.22	5.32	5.42
E	1.27 TYP		
F	0.40	0.50	0.60
F1	0.50	0.60	0.70
L	9.77	9.97	10.17
L1	2.67	2.87	3.07
L2	6.02	6.10	6.18
N	0.55	0.65	0.75

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