

**N-Ch and P-Ch Power MOSFET**

**GENERAL DESCRIPTION**

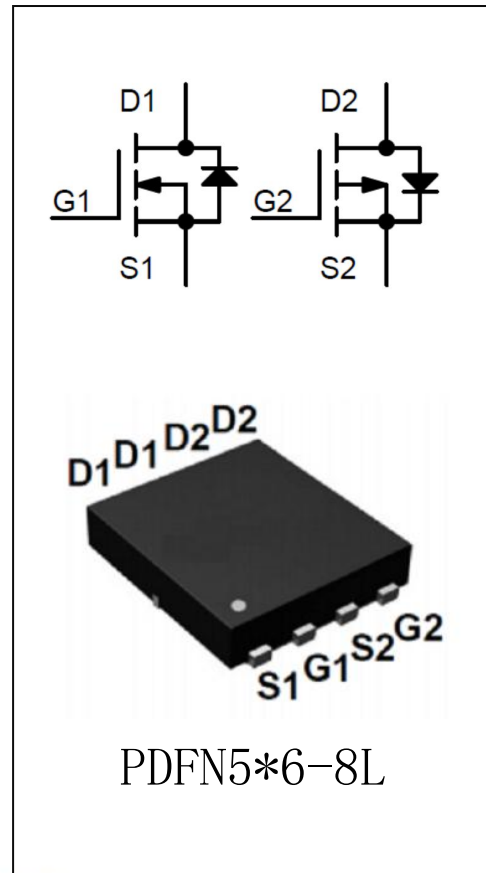
Complementary Enhancement MOSFET in a PDFN5\*6 Package. The SFM0320T4 uses advanced trench technology and design to provide excellent  $R_{DS(on)}$  with low gate charge can be used in a wide variety of applications.

**Features**

- ◆ N-CHANNEL  
 $V_{DS}=30V, I_D=32A$   
 $R_{DS(on)(TYP)}=8.3m\Omega; (V_{GS}=10V, I_D=15A)$   
 $R_{DS(on)(TYP)}=11.2m\Omega; (V_{GS}=4.5V, I_D=10A)$
- ◆ P-CHANNEL  
 $V_{DS}=-30V, I_D=-24A$   
 $R_{DS(on)(TYP)}=13.6m\Omega; (V_{GS}=-10V, I_D=-10A)$   
 $R_{DS(on)(TYP)}=17.5m\Omega; (V_{GS}=-4.5V, I_D=-5A)$

**Applications**

- ◆ Power faction correction (PFC)
- ◆ Switched mode power supplies (SMPS)
- ◆ Uninterruptible power supply (UPS)
- ◆ LED lighting power



**ORDERING INFORMATION**

Part No.	Package	Marking	Material	Packing
SFM0320T4	PDFN 5*6-8L	M0320T4	Pb Free	Reel

## ABSOLUTE MAXIMUM RATINGS (T<sub>J</sub>=25°C unless otherwise noted)

Characteristics		Symbol	N-CHANNEL	P-CHANNEL	Unit
Drain-Source Voltage		V <sub>DS</sub>	30	-30	V
Gate-Source Voltage		V <sub>GS</sub>	±20	±20	V
Drain Current	T <sub>C</sub> = 25°C	I <sub>D</sub>	32	-24	A
	T <sub>C</sub> = 100°C		24	-19	
Drain Current Pulsed(Note 1)		I <sub>DM</sub>	112	-84	A
Power Dissipation(T <sub>C</sub> =25°C)		P <sub>D</sub>	35		W
Operation Junction Temperature Range		T <sub>J</sub>	-55 to +150		°C
Storage Temperature Range		T <sub>stg</sub>	-55 to +150		°C
Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		TL	300		°C

## THERMAL CHARACTERISTICS

Characteristics	Symbol	MAX	Unit
Thermal Resistance, Junction-to-Case	R <sub>θJC</sub>	3.6	°C/W
Thermal Resistance, Junction-to-Ambient	R <sub>θJA</sub>	62.5	°C/W

## N-Ch ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
Drain -Source Breakdown Voltage	B <sub>VDS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	30	33	--	V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V	--	4.5	100	nA
Gate-Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =20V, V <sub>DS</sub> =0V	--	0.5	100	nA
Gate-Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =-20V, V <sub>DS</sub> =0V	--	-1.0	-100	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> =250μA	1	1.65	2.5	V
Static Drain- Source On State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =15A	--	8.3	10	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A	--	11.2	15	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =15A	10	15.6	20	/
<b>Dynamic Characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =25V V <sub>GS</sub> =0V f=1.0MHZ	--	1865	--	pF
Output Capacitance	C <sub>oss</sub>		--	235	--	
Reverse Transfer Capacitance	C <sub>rss</sub>		--	126	--	pF
<b>Switching Characteristics</b>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =20V; V <sub>GS</sub> =4.5V R <sub>G</sub> =1.8Ω I <sub>D</sub> =20A (Note 2.3)	--	12	--	nS
Turn-on Rise Time	t <sub>r</sub>		--	76	--	
Turn-off Delay Time	t <sub>d(off)</sub>		--	135	--	
Turn-off Fall Time	t <sub>f</sub>		--	79	--	
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =20V, I <sub>D</sub> =20A V <sub>GS</sub> =4.5V (Note 2.3)	--	32.8	--	nC
Gate-Source Charge	Q <sub>gs</sub>		--	9.6	--	
Gate-Drain Charge	Q <sub>gd</sub>		--	5.5	--	

## 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	--	--	32	A
Pulsed Source Current	$I_{SM}$		--	--	112	
Diode Forward Voltage	$V_{SD}$	$I_S=20A, V_{GS}=0V$	--	0.81	1.4	V
Reverse Recovery Time	$T_{rr}$	$I=20A, V_{GS}=0V,$ $dI/dt=100A/\mu S(\text{Note 2})$	--	17	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	6.9	--	$\mu C$

NOTE:

1. Pulse width limited by maximum junction temperature
2. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$
3. Essentially independent of operating temperature

## P-Ch ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
Drain -Source Breakdown Voltage	$B_{VDSS}$	$V_{GS}=0V, I_D=-250\mu A$	-30	-36	--	V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=-30V, V_{GS}=0V$	--	-2.6	100	nA
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=20V, V_{DS}=0V$	--	0.8	100	nA
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=-20V, V_{DS}=0V$	--	-2.4	-100	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=-250\mu A$	-1	-1.4	-2.5	V
Static Drain- Source On State Resistance	$R_{DS(on)}$	$V_{GS}=-10V, I_D=-10A$	--	13.6	16.5	$m\Omega$
		$V_{GS}=-4.5V, I_D=-5A$	--	17.5	21.5	$m\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=-5V, I_D=-10A$	15	22.4	30	/
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=-15V$ $V_{GS}=0V$ $f=1.0MHz$	--	1490	--	pF
Output Capacitance	$C_{oss}$		--	206	--	
Reverse Transfer Capacitance	$C_{rss}$		--	136	--	
<b>Switching Characteristics</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-15V; V_{GS}=-10V$ $R_G=3.0\Omega, I_D=-15A$ (Note 2.3)	--	8.5	--	nS
Turn-on Rise Time	$t_r$		--	11.6	--	
Turn-off Delay Time	$t_{d(off)}$		--	29	--	
Turn-off Fall Time	$t_f$		--	22	--	
Total Gate Charge	$Q_g$	$V_{DS}=-15V, I_D=-15A$ $V_{GS}=-10V$ (Note 2.3)	--	28.6	--	nC
Gate-Source Charge	$Q_{gs}$		--	5.3	--	
Gate-Drain Charge	$Q_{gd}$		--	6.2	--	

**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	--	--	-24	A
Pulsed Source Current	$I_{SM}$		--	--	-84	
Diode Forward Voltage	$V_{SD}$	$I_S=20A, V_{GS}=0V$	--	-0.88	-1.4	V
Reverse Recovery Time	$T_{rr}$	$I=20A, V_{GS}=0V,$ $dI/dt=100A/\mu S(\text{Note 2})$	--	26	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	9.3	--	$\mu C$

NOTE:

1. Pulse width limited by maximum junction temperature
2. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$
3. Essentially independent of operating temperature

N-Channel Typical Performance Characteristics

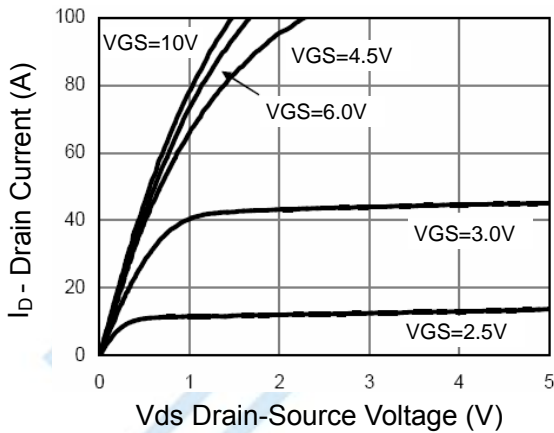


Figure 1 Output Characteristics

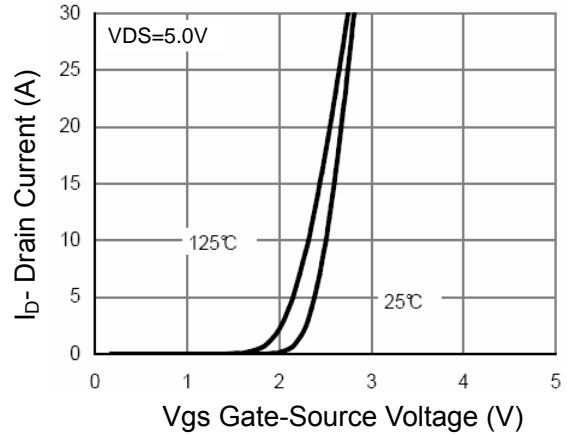


Figure 2 Transfer Characteristics

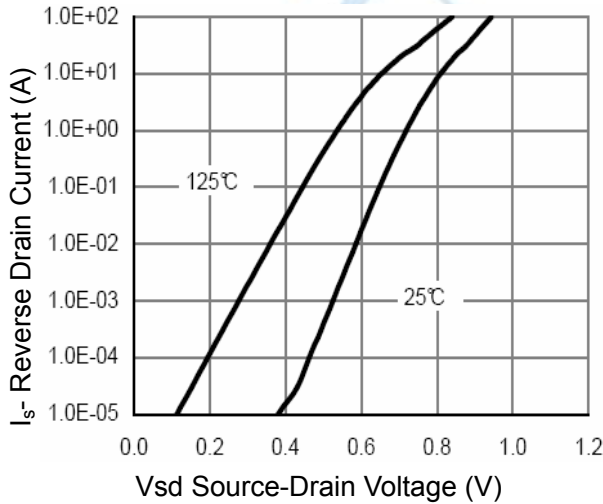


Figure 3 Source- Drain Diode Forward

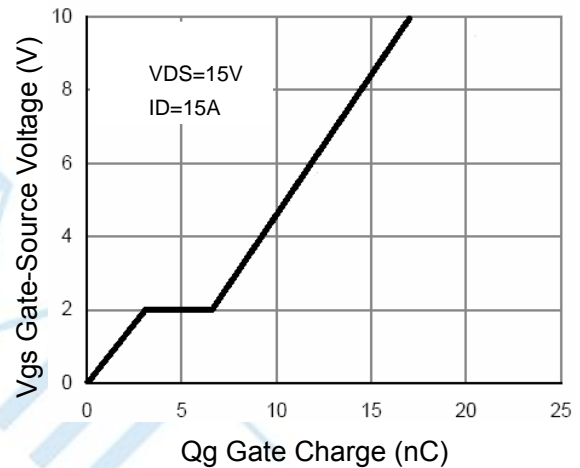


Figure 4 Gate Charge

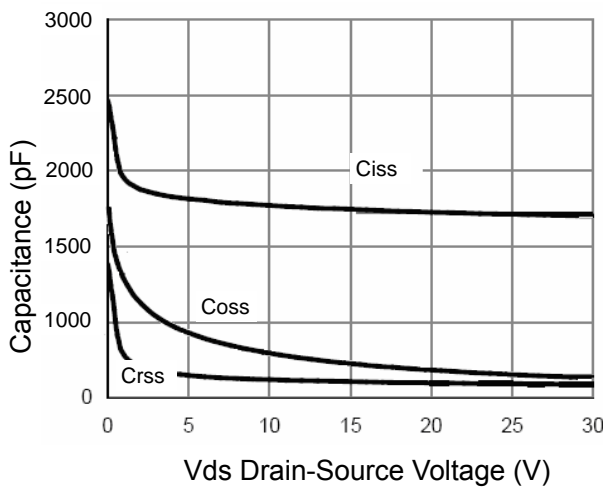


Figure 5 Capacitance vs Vds

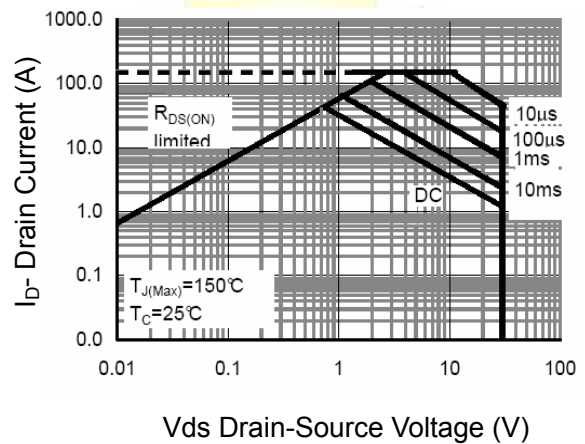


Figure 6 Safe Operation Area

N-Channel Typical Performance Characteristics

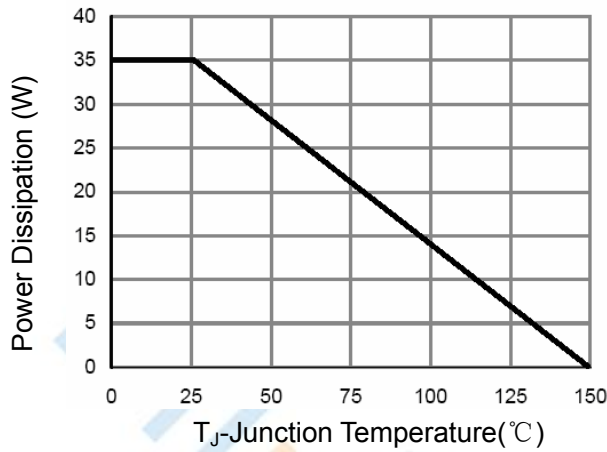


Figure 7 Power De-rating

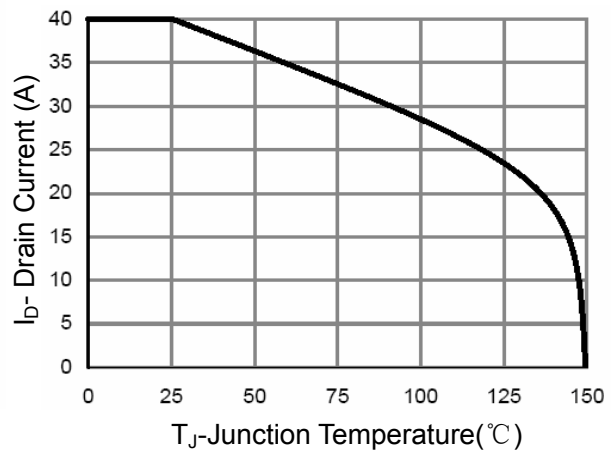


Figure 8 I<sub>D</sub> Current De-rating

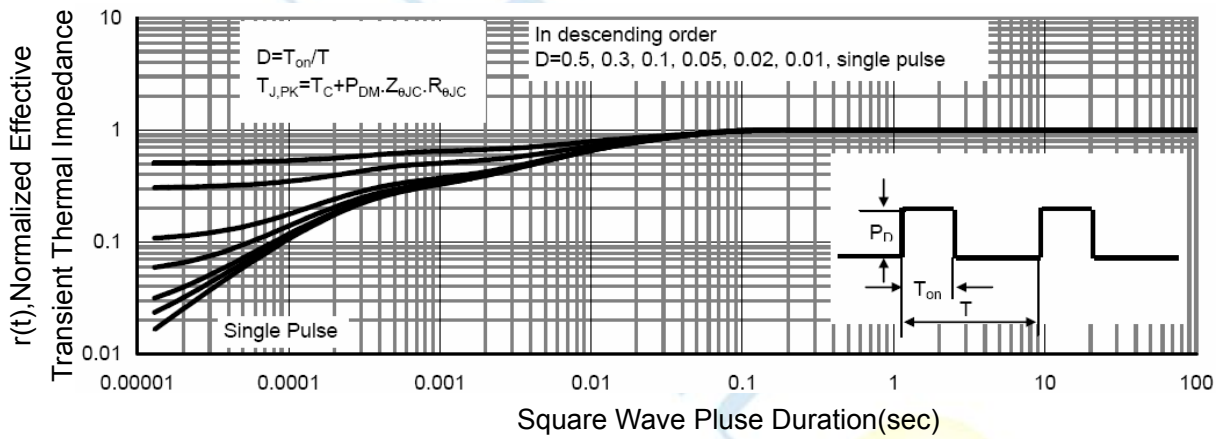


Figure 9 Normalized Maximum Transient Thermal Impedance

P-Channel Typical Performance Characteristics

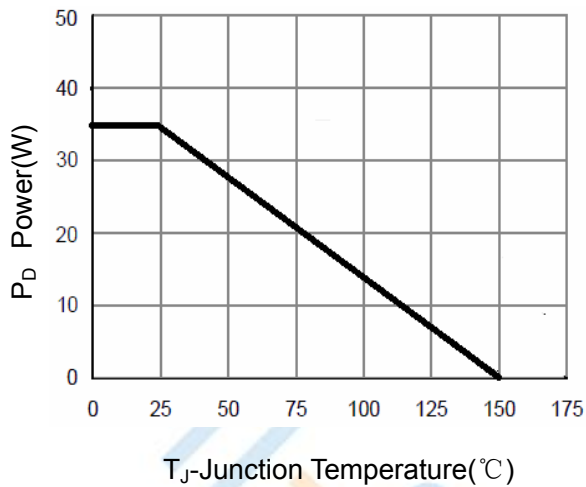


Figure 1: Switching Test Circuit

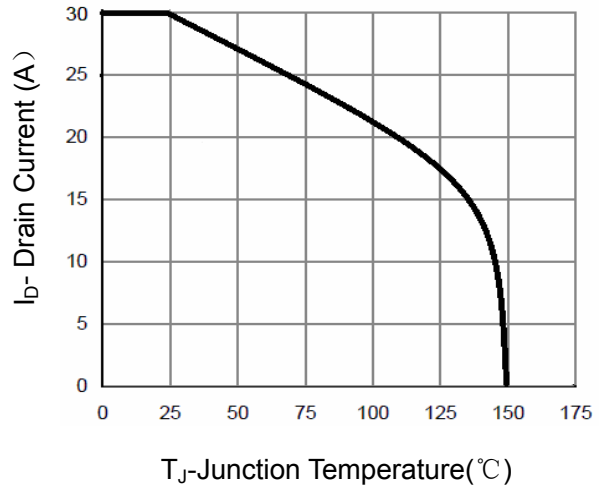


Figure 2: Switching Waveforms

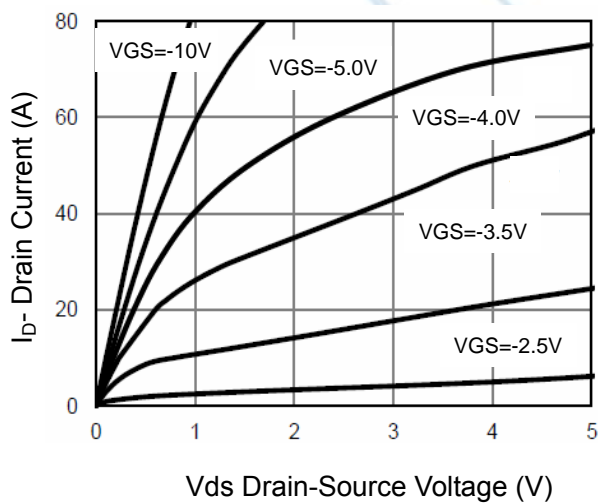


Figure 3 Power Dissipation

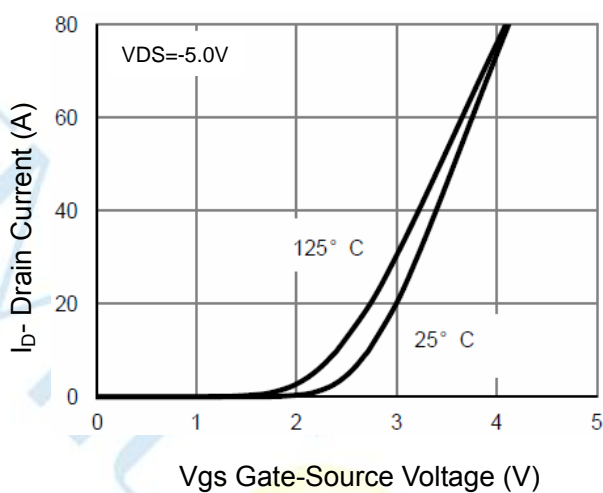


Figure 4 Transfer Characteristics

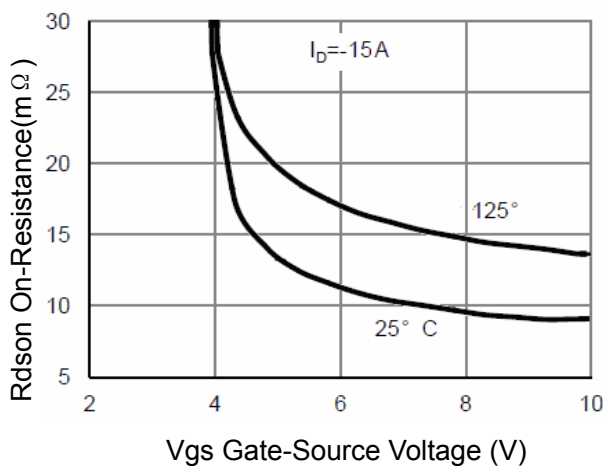


Figure 5 Rds(on) vs Vgs

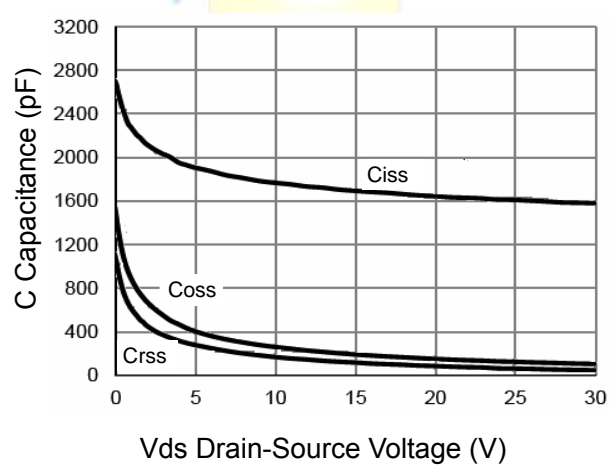


Figure 6 Capacitance vs Vds

P-Channel Typical Performance Characteristics

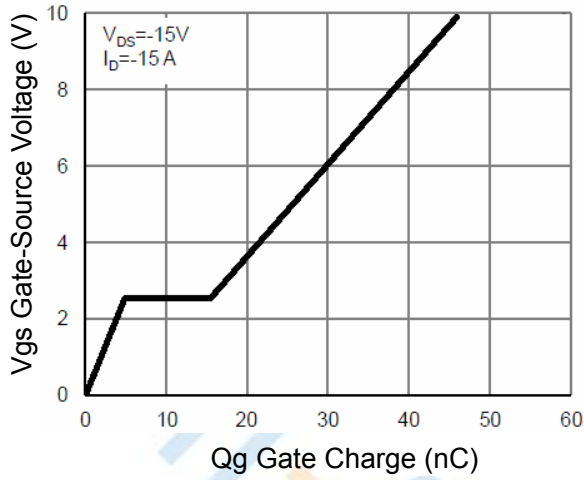


Figure 7 Gate Charge

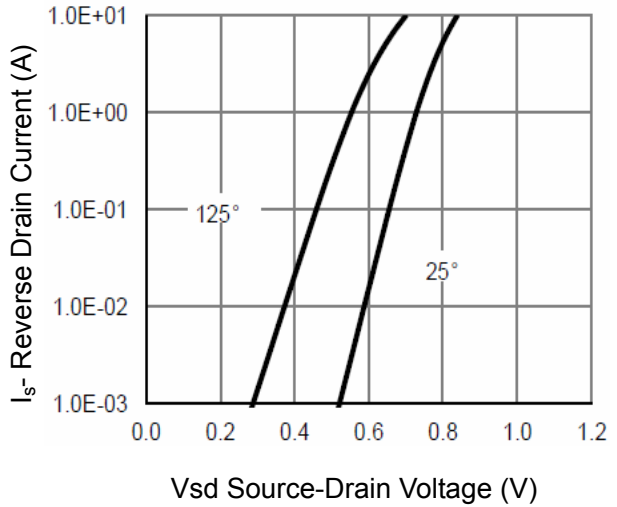


Figure 8 Source- Drain Diode Forward

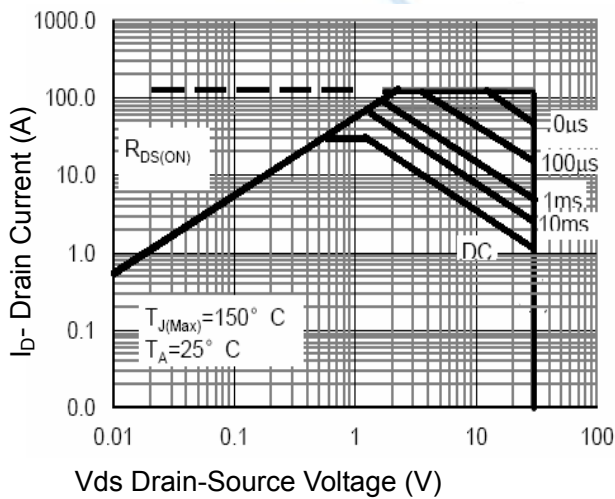


Figure 9 Safe Operation Area

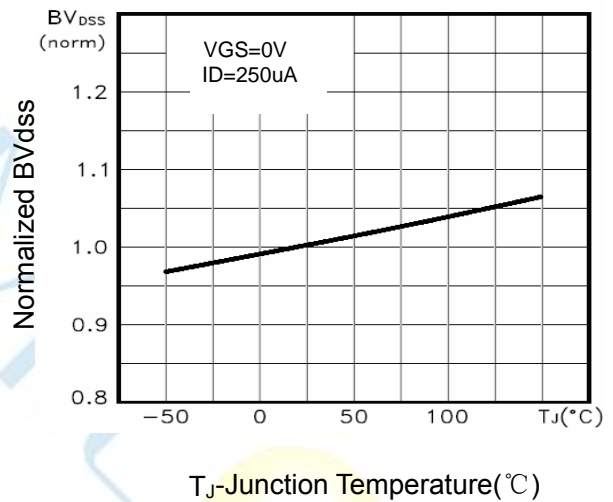


Figure 10 BV<sub>DSS</sub> vs Junction Temperature

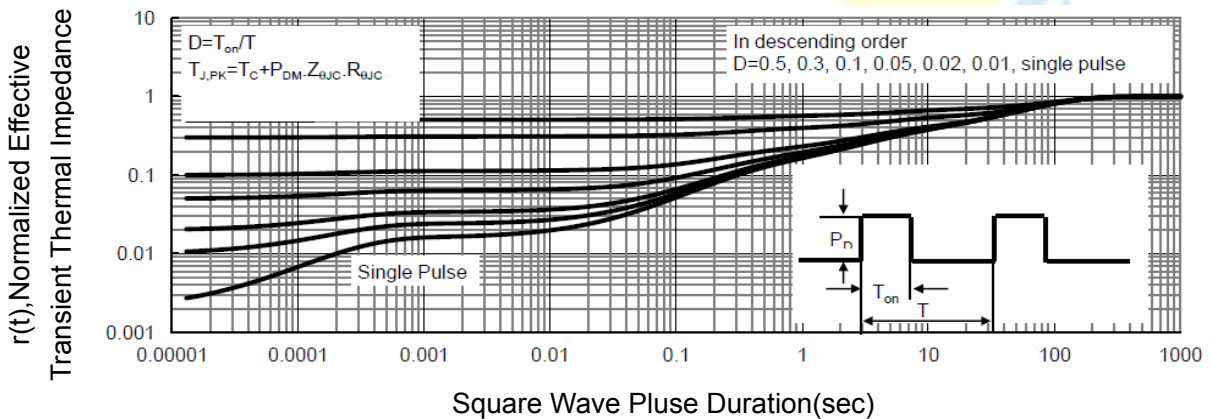
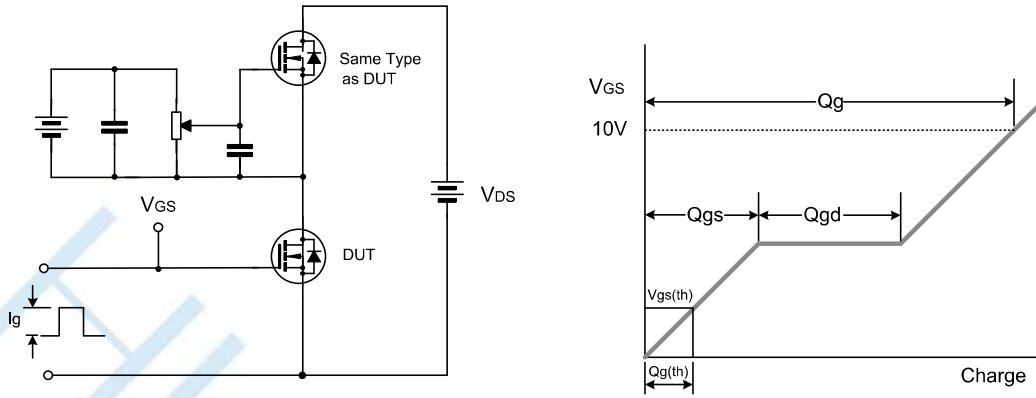


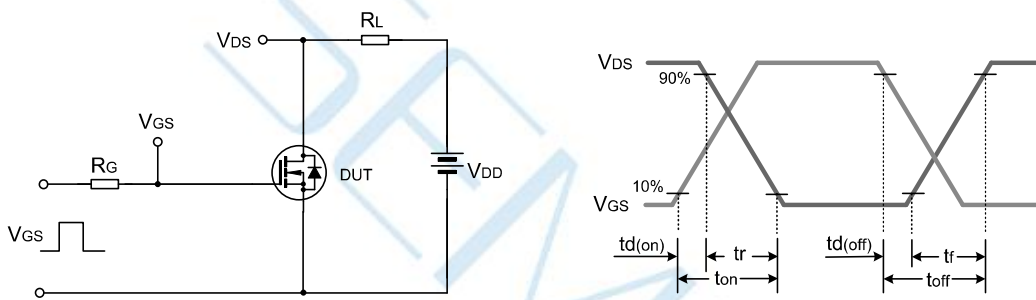
Figure 11 Normalized Maximum Transient Thermal Impedance



Test Circuit



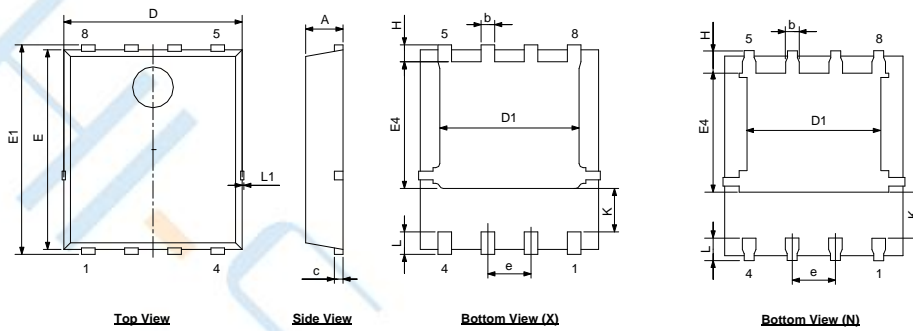
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform

Package Dimensions of PDFN5\*6-8L

Unit:mm



SYMBOL	X			N		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.90	1.10	1.30	0.90	0.95	1.00
c	0.154	0.254	0.354	0.21	0.25	0.34
D	4.90	5.20	5.50	4.80	4.90	5.00
E	5.56	5.86	6.16	5.70	5.75	5.80
D1	3.80	4.10	4.30	3.91	4.01	4.11
E1	5.85	6.15	6.45	5.90	6.00	6.10
b	0.20	0.40	0.60	0.35	0.45	0.55
K	1.10	1.30	1.50	1.10	--	--
e	1.07	1.27	1.37	1.17	1.27	1.37
E4	3.52	3.72	3.92	3.34	3.44	3.54
L	0.36	0.66	0.76	0.51	0.61	0.71
L1	--	--	0.12	--	--	0.10
H	0.30	0.50	0.70	0.51	0.61	0.71

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