

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

**GENERAL DESCRIPTION**

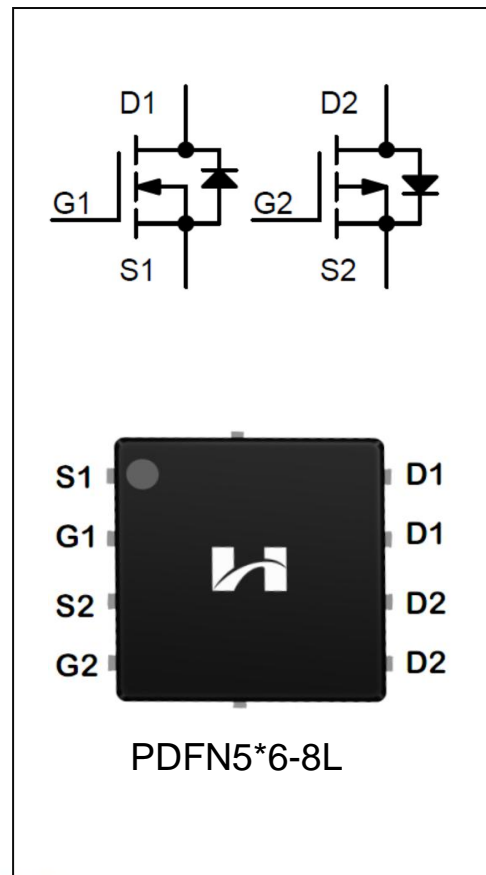
Complementary Enhancement MOSFET in a PDFN5\*6 Package. The SFM0320T4 uses advanced trench technology and design to provide excellent  $R_{DS(on)}$  with low gate charge can be used in a wide variety of applications.

**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 factor 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	SFM0320T4	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	1.6	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

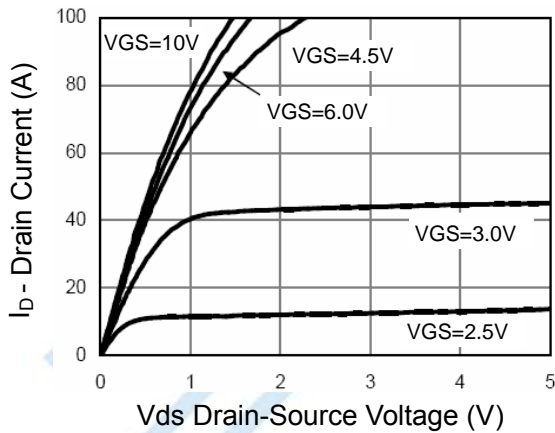


Figure 1 Output Characteristics

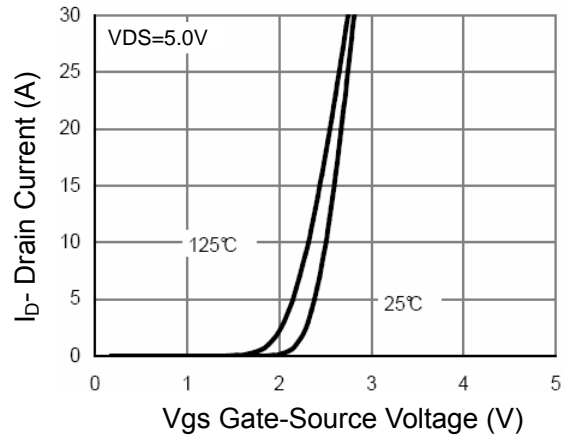


Figure 2 Transfer Characteristics

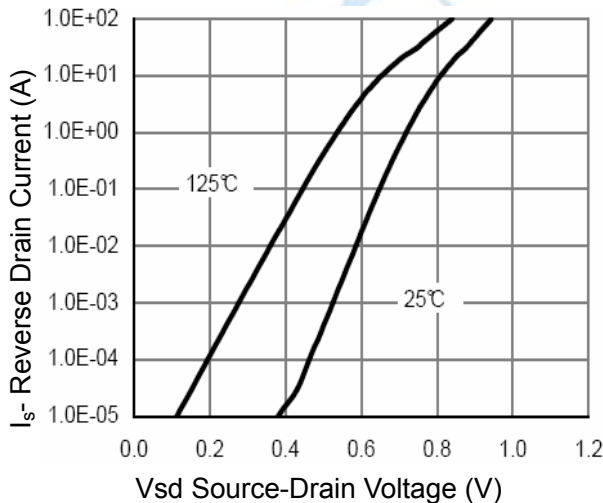


Figure 3 Source- Drain Diode Forward

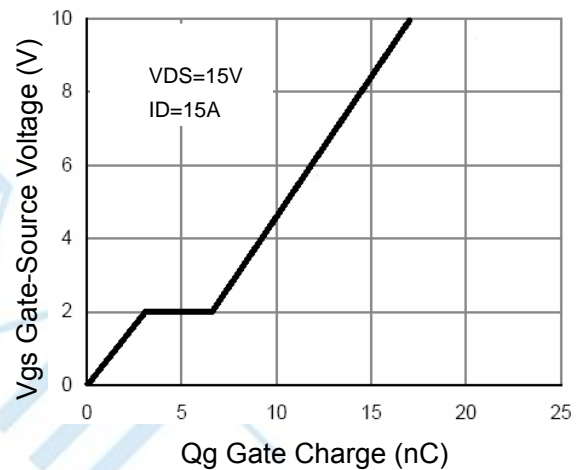


Figure 4 Gate Charge

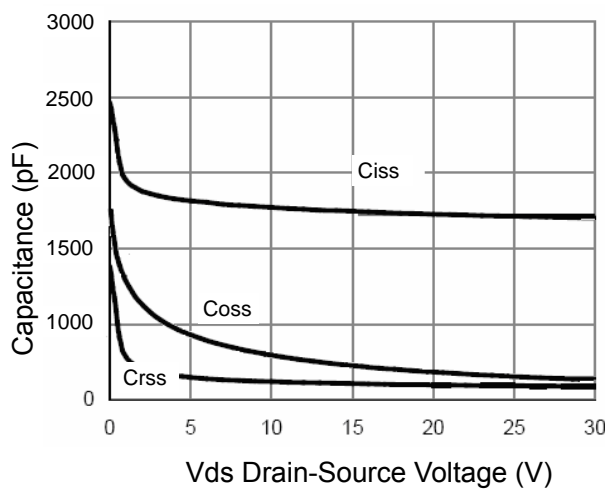


Figure 5 Capacitance vs Vds

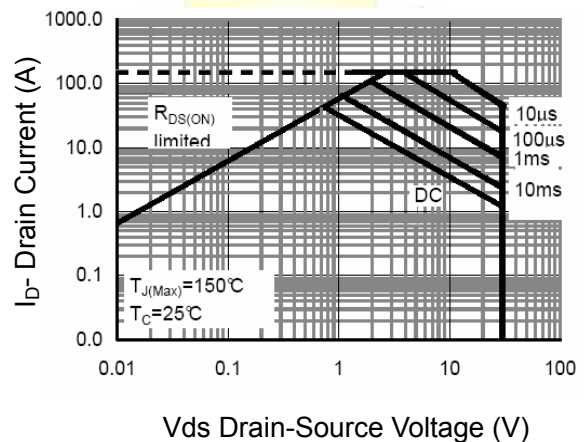


Figure 6 Safe Operation Area

N-Channel Typical Performance Characteristics

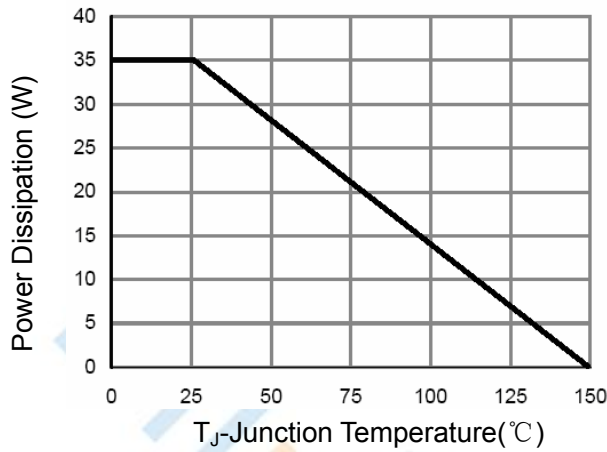


Figure 7 Power De-rating

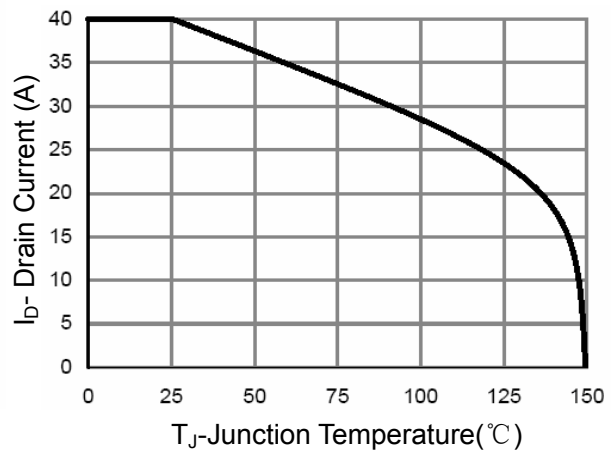


Figure 8 I<sub>D</sub> Current De-rating

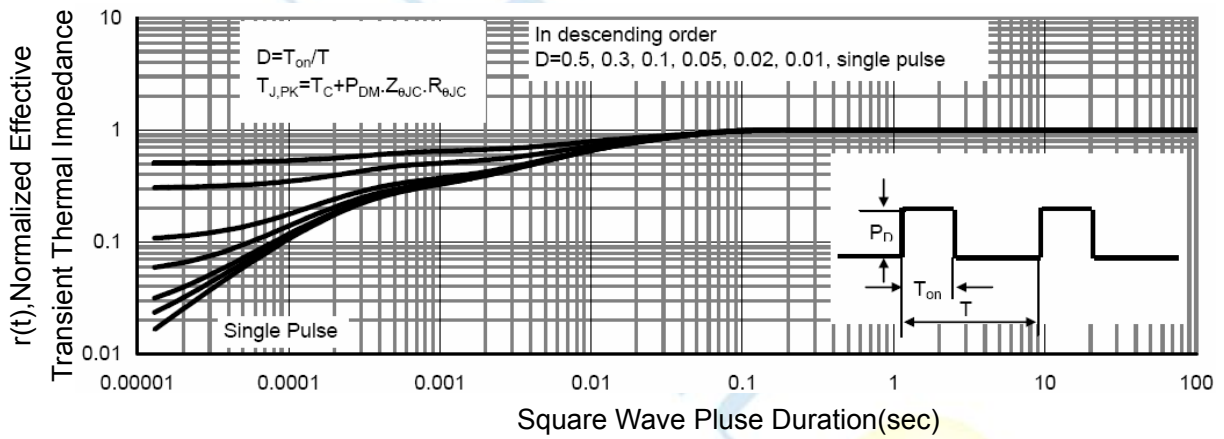


Figure 9 Normalized Maximum Transient Thermal Impedance

P-Channel Typical Performance Characteristics

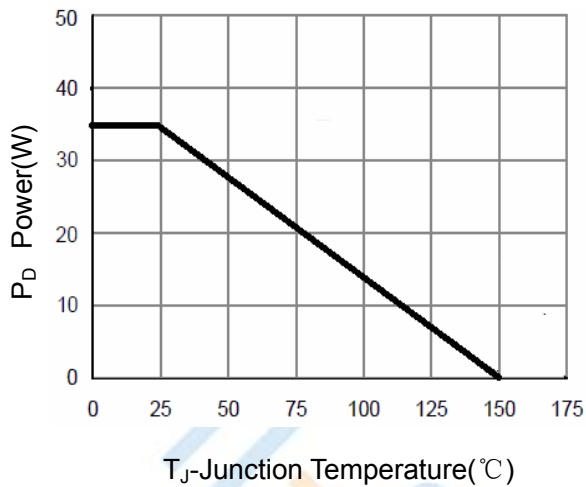


Figure 1: Switching Test Circuit

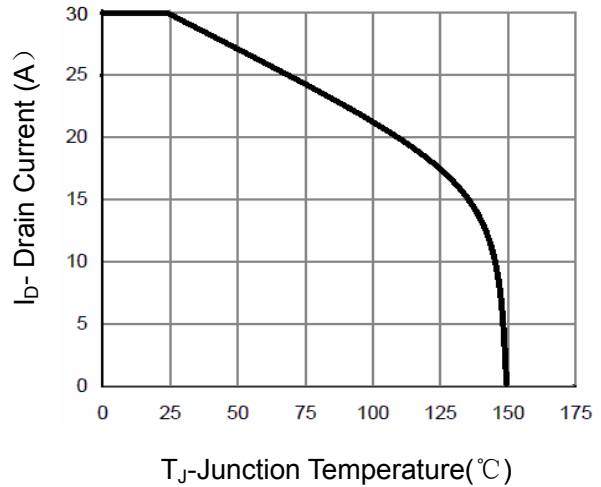


Figure 2: Switching Waveforms

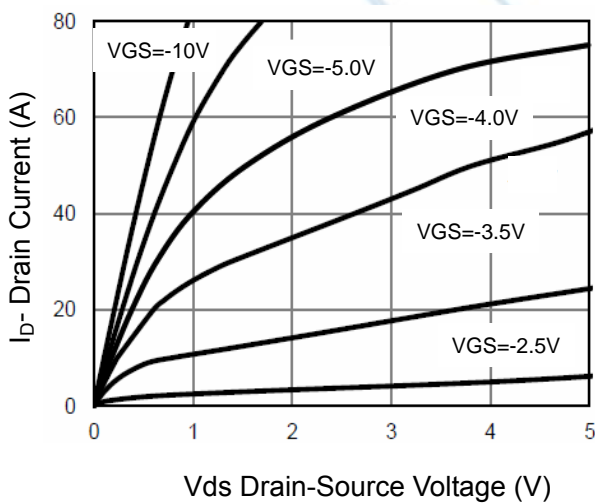


Figure 3 Power Dissipation

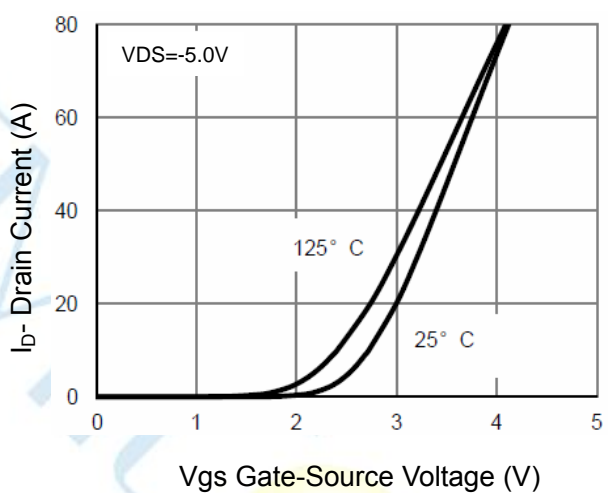


Figure 4 Transfer Characteristics

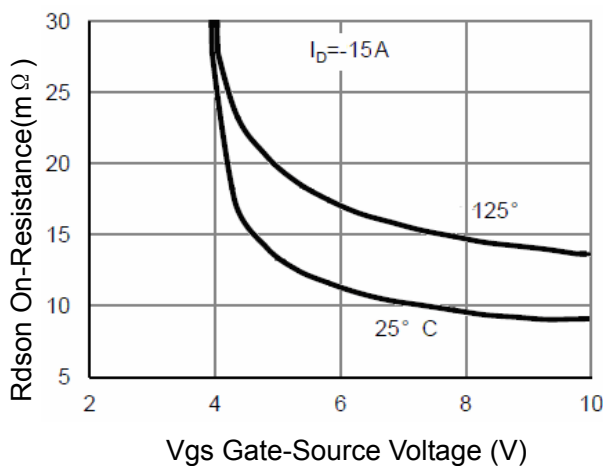


Figure 5 Rds(on) vs Vgs

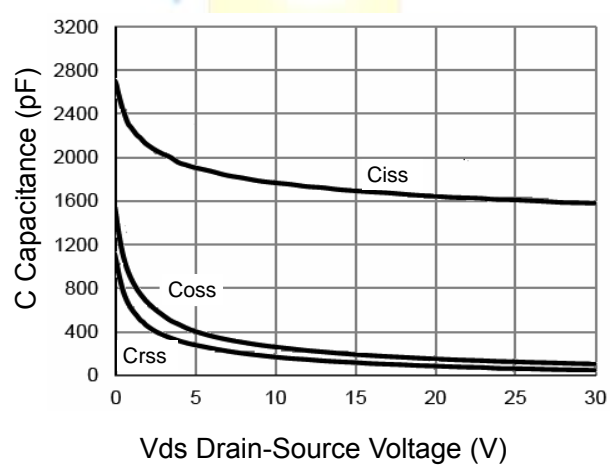


Figure 6 Capacitance vs Vds



P-Channel Typical Performance Characteristics

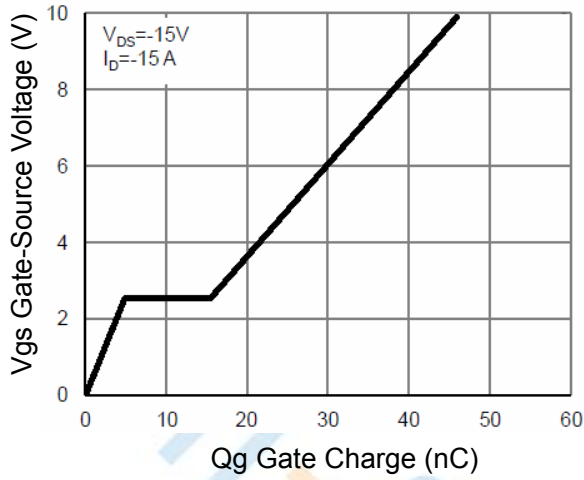


Figure 7 Gate Charge

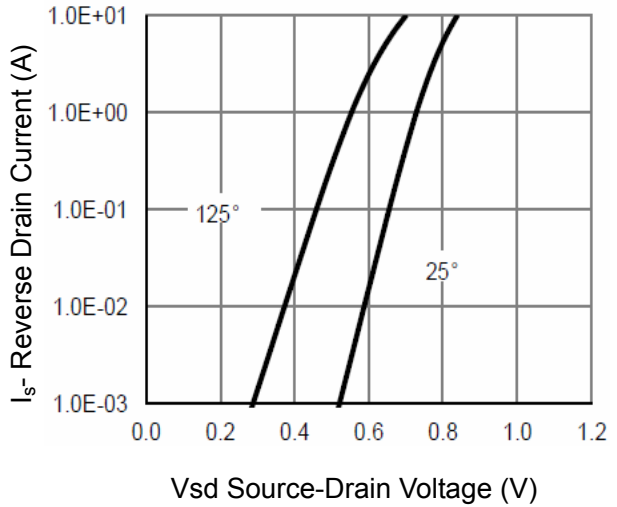


Figure 8 Source- Drain Diode Forward

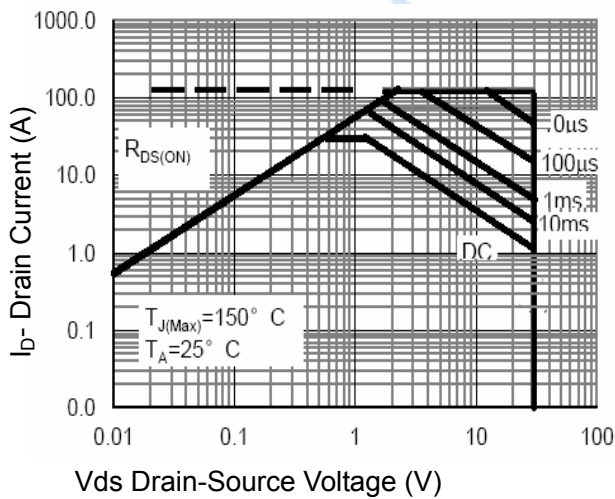


Figure 9 Safe Operation Area

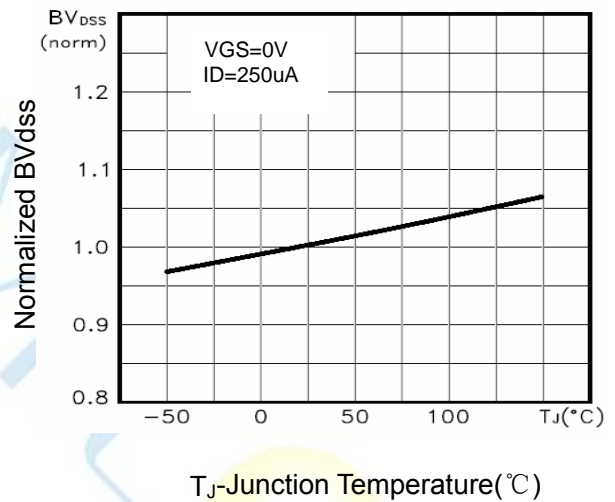


Figure 10 BV<sub>DSS</sub> vs Junction Temperature

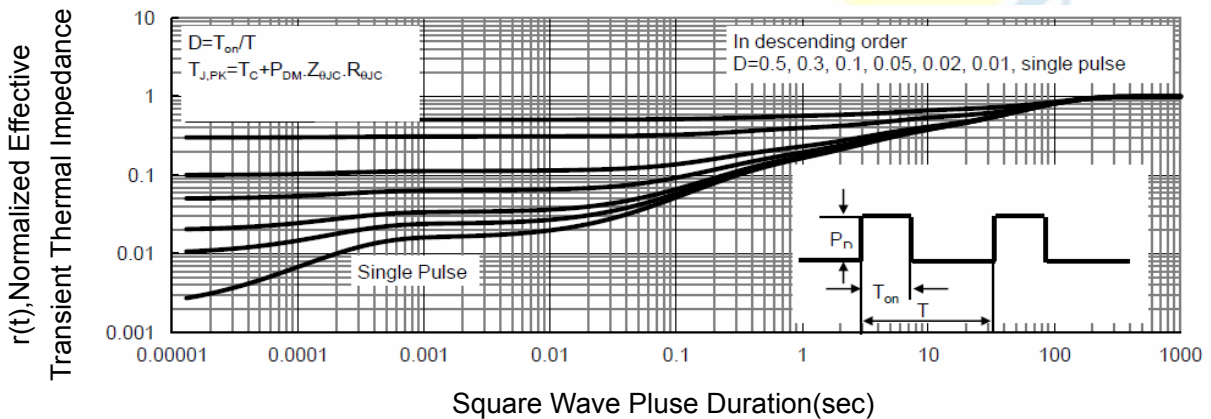
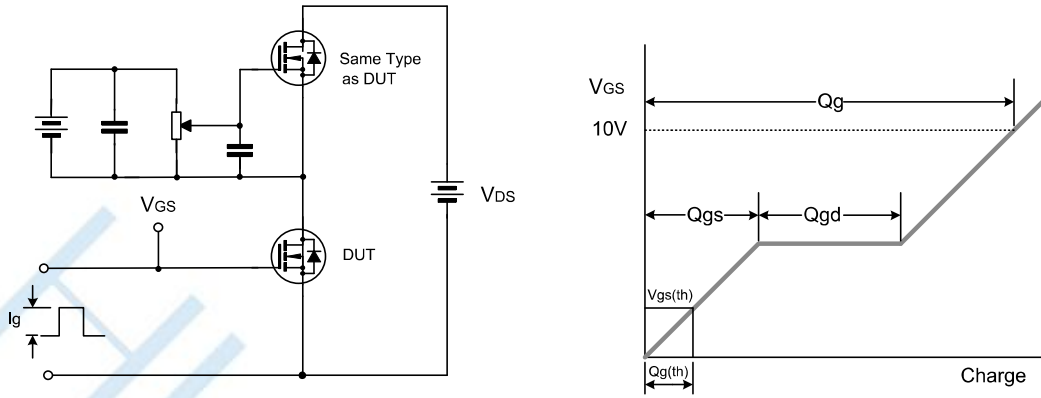


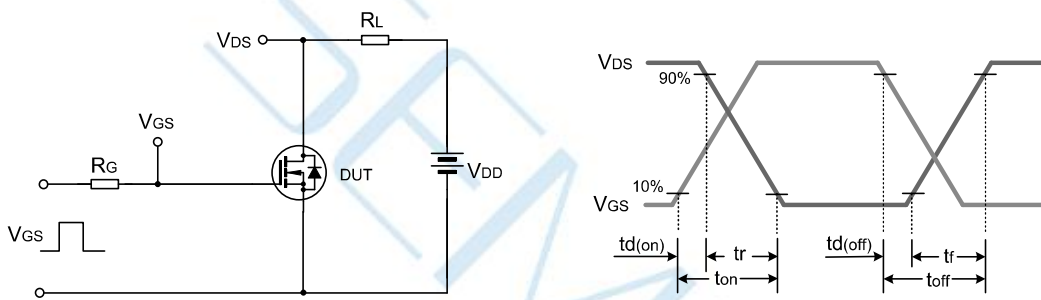
Figure 11 Normalized Maximum Transient Thermal Impedance



Test Circuit



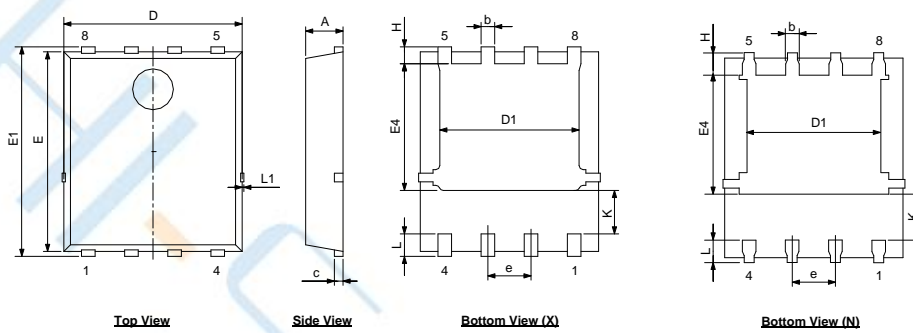
Gate Charge Test Circuit & Waveform



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

**Disclaimer:**

- ▶ Hi-semicon reserves the right to make changes to the information herein for the improvement of the design and performance without further notice! Customers should obtain the latest relevant information before placing orders and should verify that such information is complete and current.
- ▶ All semiconductor products malfunction or fail with some probability under special conditions. When using Hi-semicon products in system design or complete machine manufacturing, it is the responsibility of the buyer to comply with the safety standards strictly and take essential measures to avoid situations in which a malfunction or failure of such Hi-semicon products could cause loss of body injury or damage to property.
- ▶ Hi-semicon will supply the best possible product for customers!