

### General Description

The XPX413FD uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as -4.5V. This device is suitable for use as a wide variety of applications.

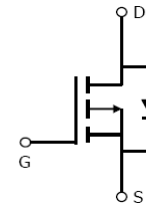
### Features

- $V_{DS} = -40V, I_D = -20A$   
 $R_{DS(ON)} = 28m\Omega @ V_{GS} = -10V$   
 $R_{DS(ON)} = 45m\Omega @ V_{GS} = -4.5V$
- High Power and current handling capability
- Lead free product is acquired
- Surface Mount Package

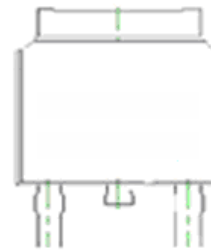
### Application

- PWM applications
- Load switch
- Power management

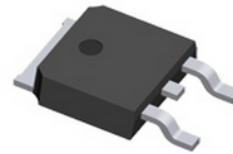
**100% UIS TESTED!**  
**100%  $\Delta V_{ds}$  TESTED!**



Schematic Diagram



Marking and pin Assignment



TO-252(DPAK) top view

**Table 1. Absolute Maximum Ratings ( $T_A=25^\circ C$ )**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-Source Voltage ( $V_{GS}=0V$ )	-40	V
$V_{GS}$	Gate-Source Voltage ( $V_{DS}=0V$ )	$\pm 20$	V
$I_D$	Drain Current-Continuous( $T_C=25^\circ C$ )	-20	A
	Drain Current-Continuous( $T_C=100^\circ C$ )	-14	A
$I_{DM (pluse)}$	Drain Current-Continuous@ Current-Pulsed <sup>(Note 1)</sup>	-80	A
$P_D$	Maximum Power Dissipation( $T_C=25^\circ C$ )	37.5	W
	Maximum Power Dissipation( $T_C=100^\circ C$ )	19	W
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 To 175	$^\circ C$

**Table 2. Thermal Characteristic**

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	4	$^\circ C/W$

## P-Channel Trench Power MOSFET

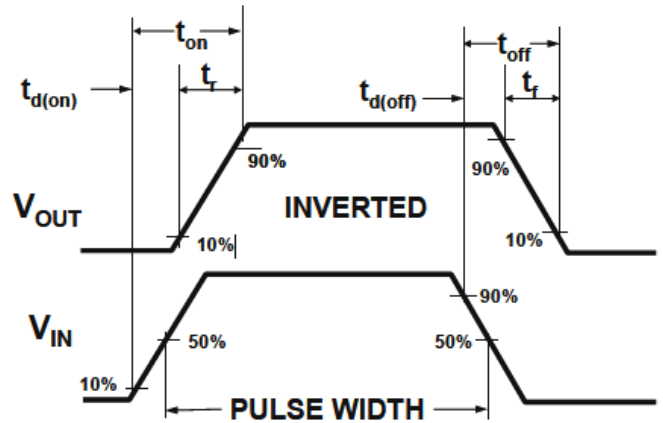
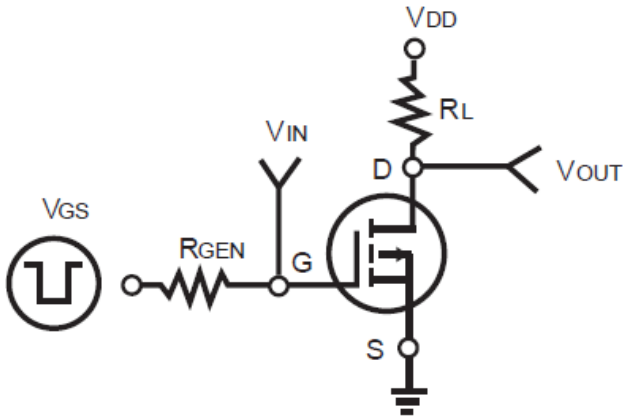
**Table 3. Electrical Characteristics (TA=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>On/Off States</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V I <sub>D</sub> =-250μA	-40			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =-32V, V <sub>GS</sub> =0V			-1	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-1	-2	-3	V
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-10A		25		S
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance	V <sub>GS</sub> =-10V, I <sub>D</sub> =-20A		28	38	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-10A		45	55	mΩ
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-25V, V <sub>GS</sub> =0V, f=1.0MHz		840		pF
C <sub>oss</sub>	Output Capacitance			92		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			60		pF
<b>Switching Times</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-20V, R <sub>L</sub> =1.6Ω, R <sub>GEN</sub> =3Ω		5		nS
t <sub>r</sub>	Turn-on Rise Time			12		nS
t <sub>d(off)</sub>	Turn-Off Delay Time			20		nS
t <sub>f</sub>	Turn-Off Fall Time			4.5		nS
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-20V, I <sub>D</sub> =-15A		20		nC
Q <sub>gs</sub>	Gate-Source Charge			2.5		nC
Q <sub>gd</sub>	Gate-Drain Charge			4.5		nC
<b>Source-Drain Diode Characteristics</b>						
I <sub>SD</sub>	Source-Drain Current(Body Diode)				-20	A
V <sub>SD</sub>	Forward on Voltage	V <sub>GS</sub> =0V, I <sub>s</sub> =-20A			-1.2	V

Notes 1.Repetitive Rating: Pulse width limited by maximum junction temperature

## P-Channel Trench Power MOSFET

### Switch Time Test Circuit and Switching Waveforms:



### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure1. Power Dissipation

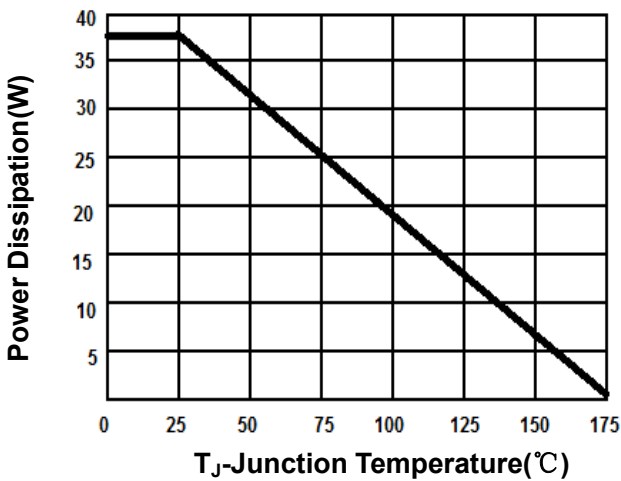


Figure2. Drain Current

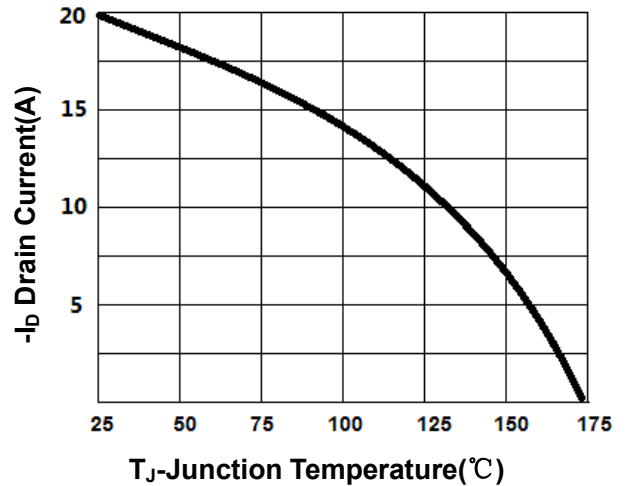


Figure3. Output Characteristics

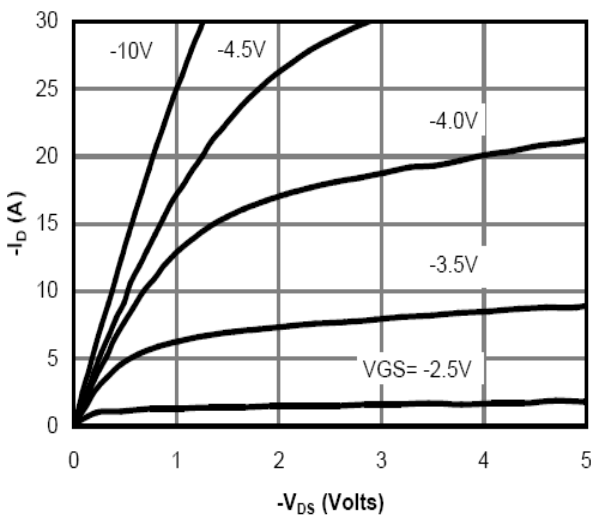
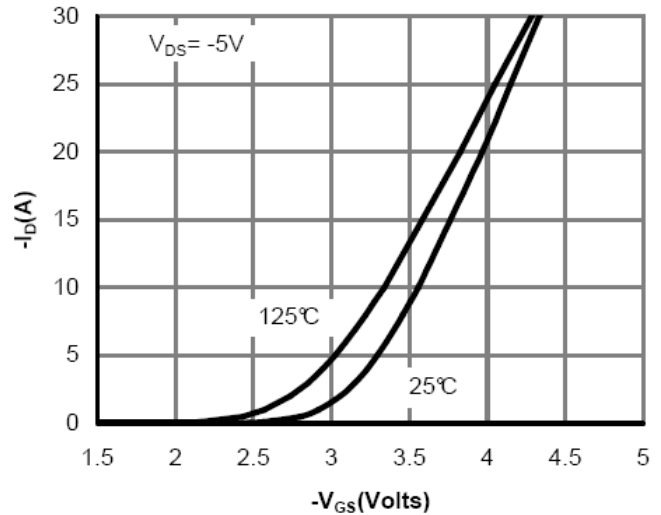


Figure4. Transfer Characteristics



## P-Channel Trench Power MOSFET

Figure5. Capacitance

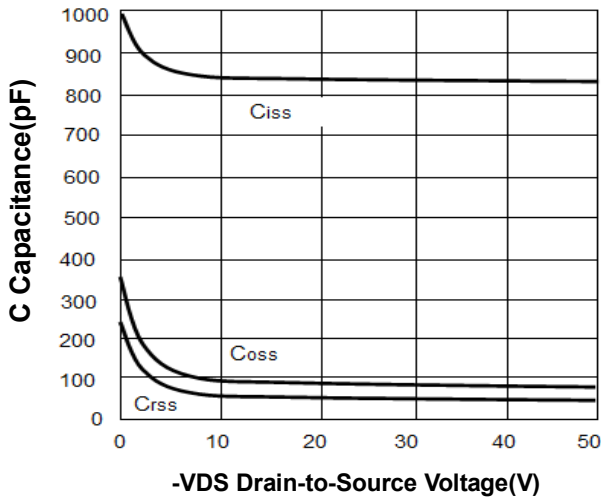


Figure6.  $R_{DS(ON)}$  vs Junction Temperature

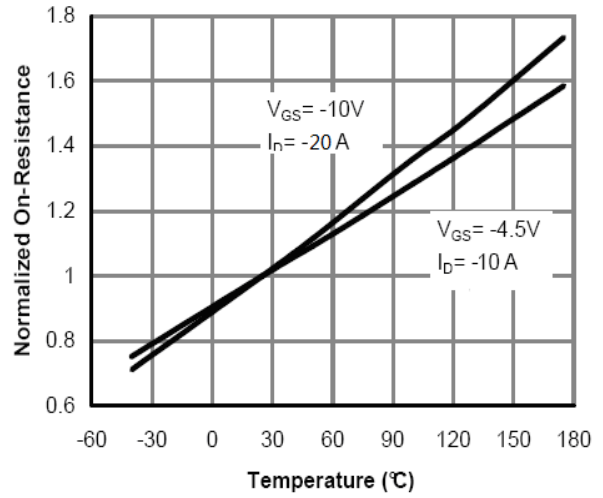


Figure7.  $V_{GS(th)}$  vs Junction Temperature

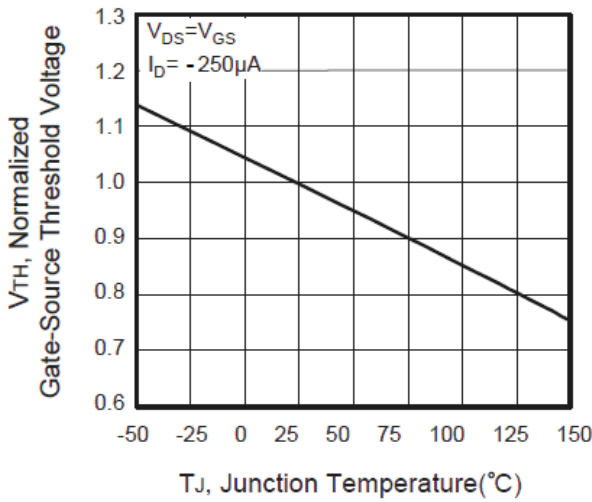


Figure8. Gate Charge Waveforms

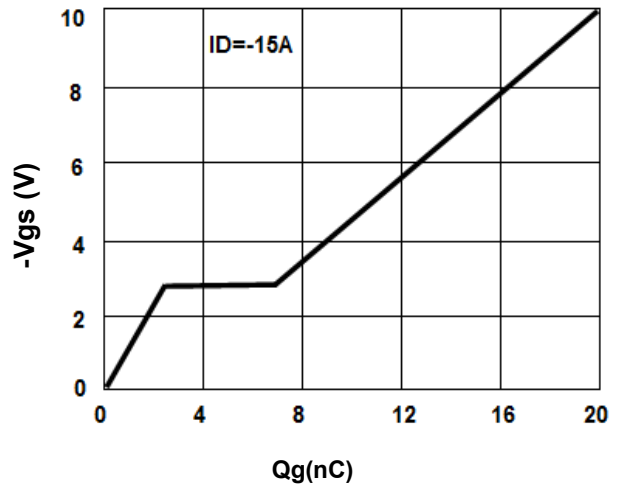
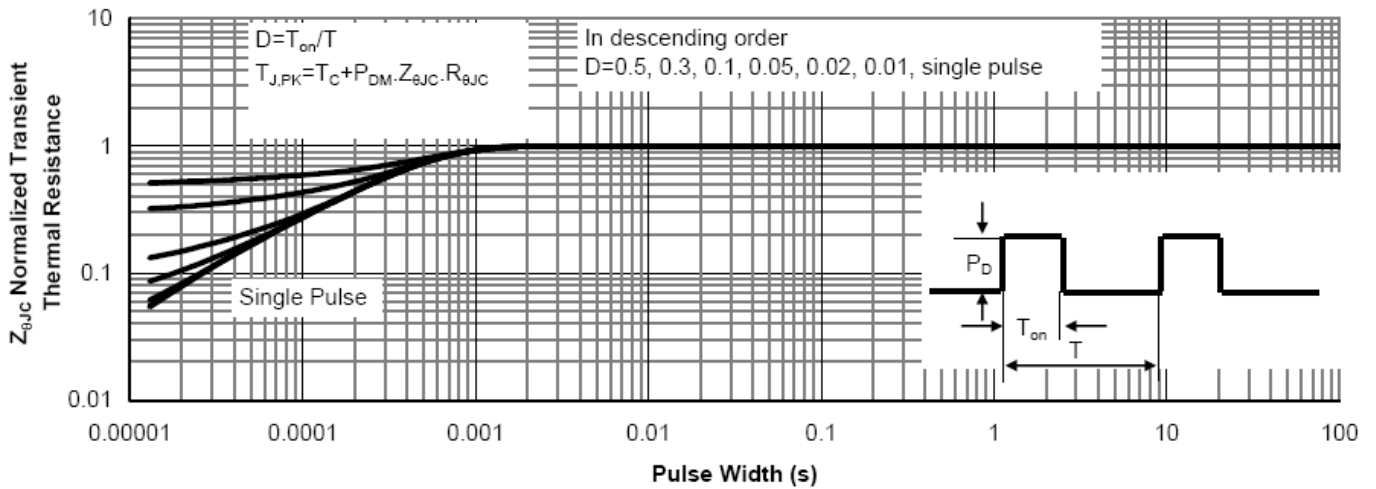
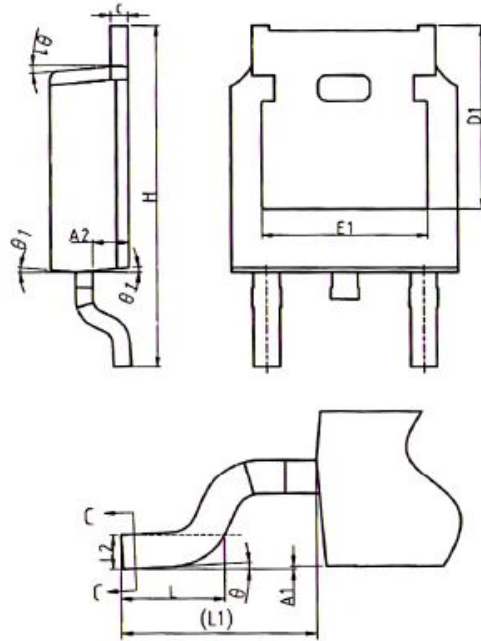
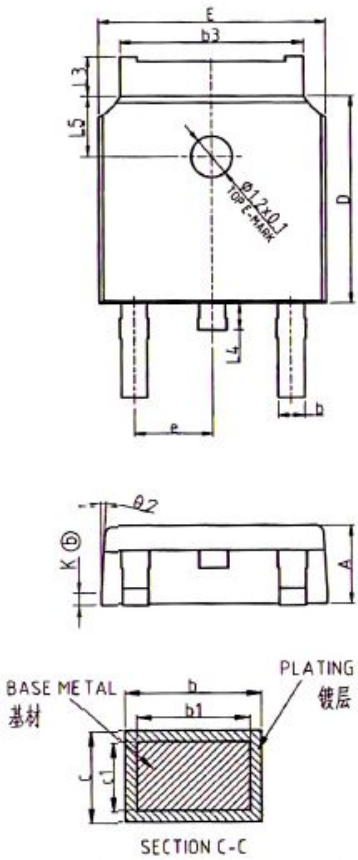


Figure9. Normalized Maximum Transient Thermal Impedance



### TO-252 Package Information



COMMON DIMENSIONS			
SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0.00	-	0.10
A2	0.97	1.07	1.17
b	0.72	0.78	0.85
b1	0.71	0.76	0.81
b3	5.23	5.33	5.46
c	0.47	0.53	0.58
c1	0.46	0.51	0.56
D	6.00	6.10	6.20
D1	5.30REF		
E	6.50	6.60	6.70
E1	4.70	4.83	4.92
e	2.286BSC		
H	9.90	10.10	10.30
L	1.40	1.50	1.70
L1	2.90REF		
L2	0.51BSC		
L3	0.90	-	1.25
L4	0.60	0.80	1.00
L5	1.70	1.80	1.90
$\theta$	0°	-	8°
$\theta 1$	5°	7°	9°
$\theta 2$	5°	7°	9°
K	0.40REF		

NOTES  
 1. ALL DIMENSIONS REFER TO JEDEC STANDARD TO-252 AA.  
 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.