

## P-Channel Enhancement Mode Power MOSFET

### Description

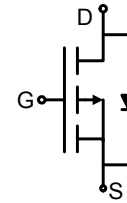
The HM20P10D uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages. This device is suitable for use as a load switching application and a wide variety of other applications.

### General Features

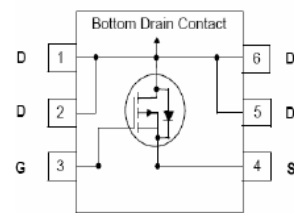
- $V_{DS} = -20V, I_D = -10A$   
 $R_{DS(ON)} < 32m\Omega @ V_{GS} = -2.5V$   
 $R_{DS(ON)} < 25m\Omega @ V_{GS} = -4.5V$
- Advanced trench MOSFET process technology
- Ultra low on-resistance with low gate charge

### Application

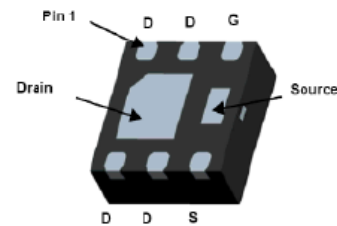
- PWM applications
- Load switch
- Battery charge in cellular handset



Schematic diagram



Pin assignment



DFN2X2-6L bottom view

### Package marking and ordering information

Device Marking	Device	Device Package	Reel Size	Tape Width	Quantity
HM20P10D	HM20P10D	DFN2X2-6L	-	-	-

### Absolute maximum ratings ( $T_C = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-20	V
Gate-Source Voltage	$V_{GS}$	$\pm 12$	V
Drain Current-Continuous	$I_D$	-10	A
Drain Current -Pulsed (Note 1)	$I_{DM}$	-40	A
Maximum Power Dissipation	$P_D$	3.5	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	36	$^\circ C/W$
--	-----------------	----	--------------

**Electrical characteristics (T<sub>A</sub>=25°C unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	V <sub>(BR) DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =-250μA	-20	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V	-	-	-1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±12V, V <sub>DS</sub> =0V	-	-	±100	nA
On Characteristics <sup>(Note 3)</sup>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-0.4	-0.85	-1.2	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-5A	-	19	25	mΩ
		V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-5A	-	26	32	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-5V, I <sub>D</sub> =-5A	20	-	-	S
Dynamic Characteristics <sup>(Note4)</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-10V, V <sub>GS</sub> =0V, F=1.0MHz	-	2947.6	-	PF
Output Capacitance	C <sub>Oss</sub>		-	467.1	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	448.3	-	PF
Switching Characteristics <sup>(Note 4)</sup>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-10V, I <sub>D</sub> =-5A V <sub>GS</sub> =-4.5V, R <sub>GEN</sub> =10Ω	-	11	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	35	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	30	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	10	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-10V, I <sub>D</sub> =-5A, V <sub>GS</sub> =-4.5V	-	33.7	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	3.5	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	10.5	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage <sup>(Note 3)</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-10A	-	-	-1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>		-	-	-10	A

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production

## Typical Electrical and Thermal Characteristics

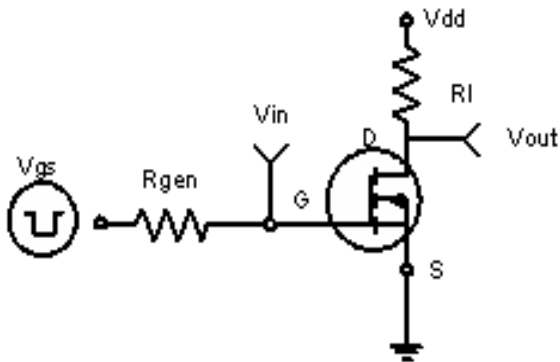


Figure 1: Switching Test Circuit

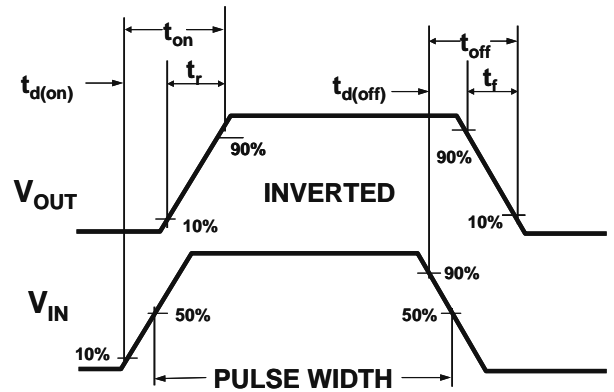


Figure 2: Switching Waveforms

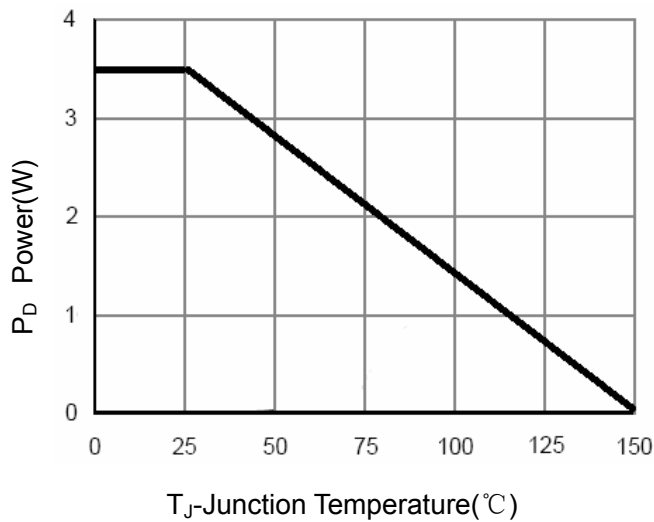


Figure 3 Power Dissipation

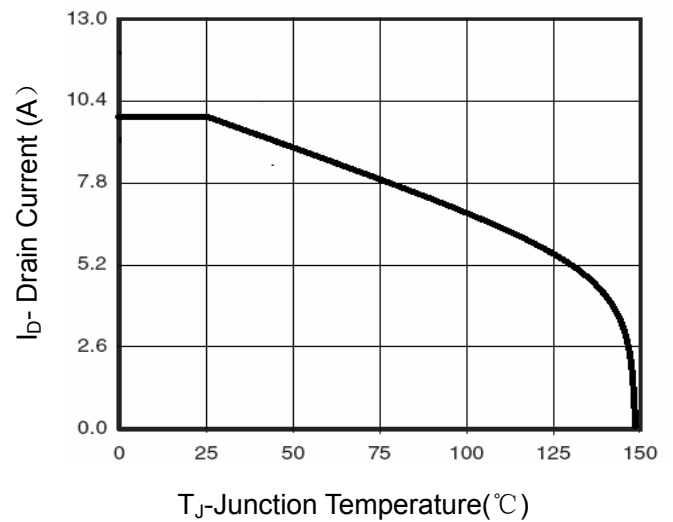


Figure 4 Drain Current

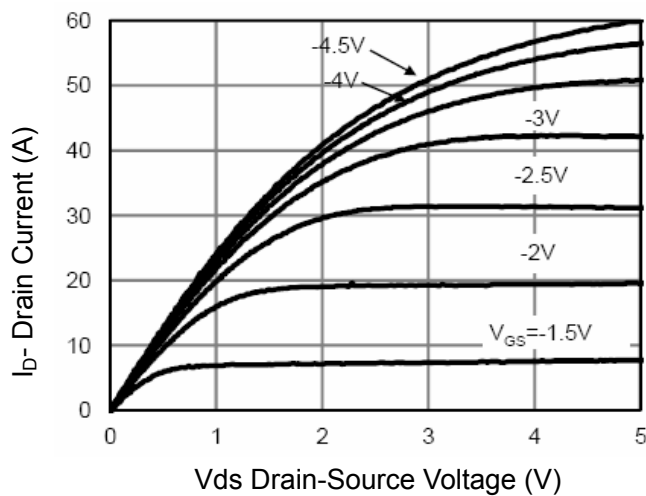


Figure 5 Output Characteristics

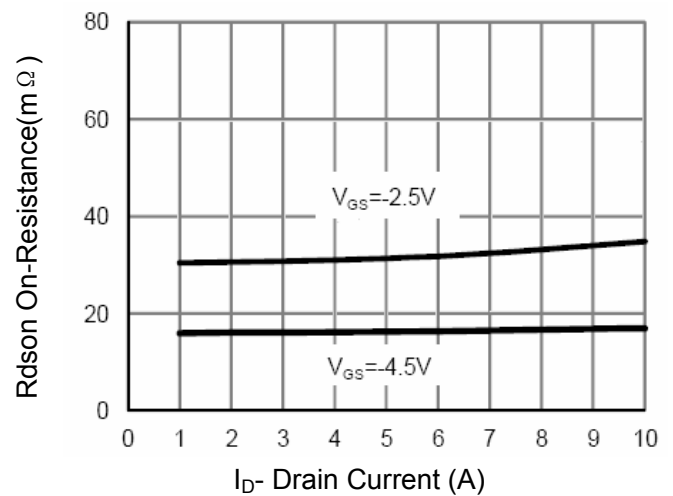
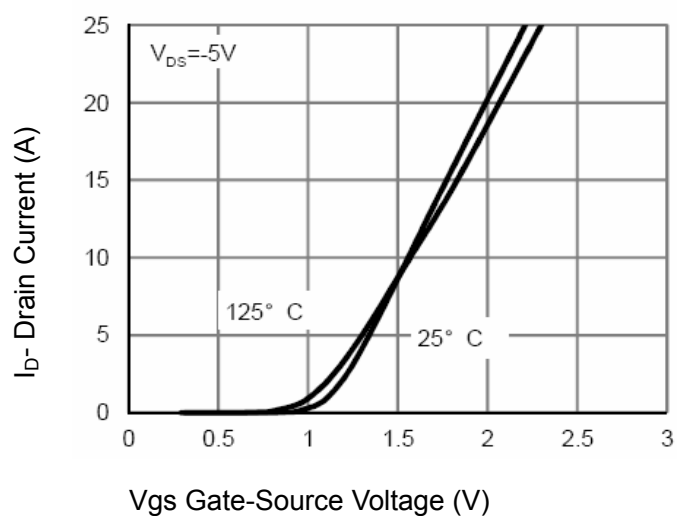
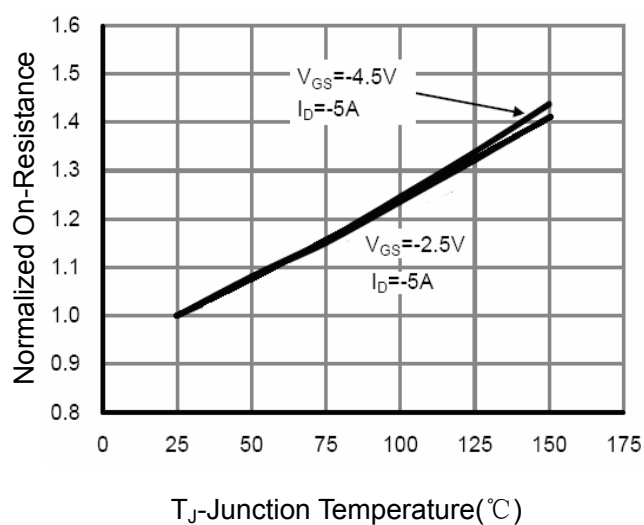


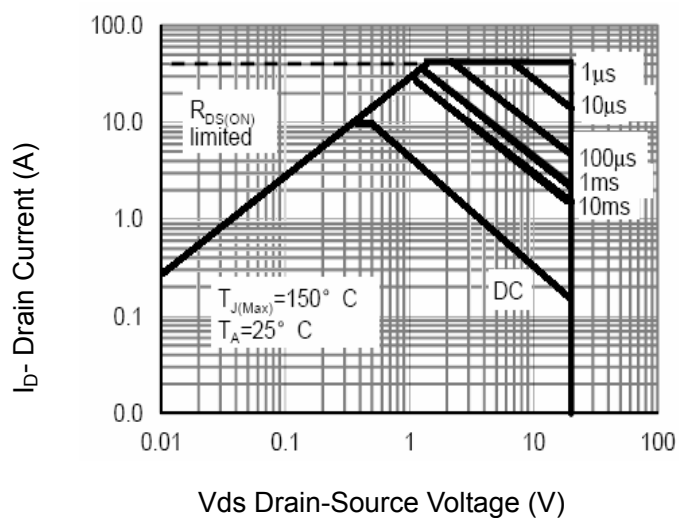
Figure 6 Drain-Source On-Resistance



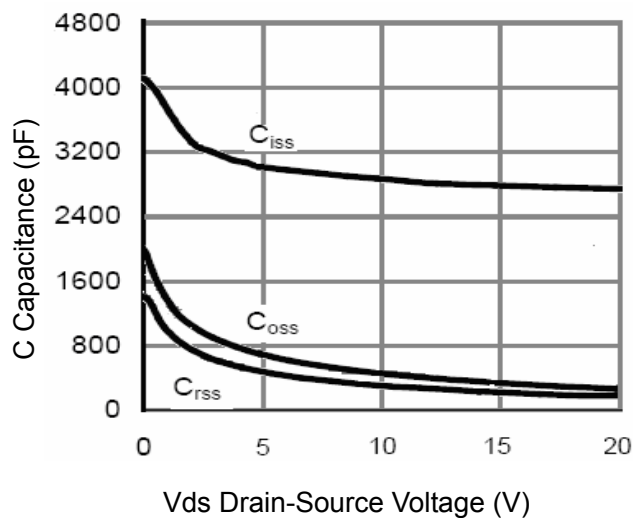
**Figure 7 Transfer Characteristics**



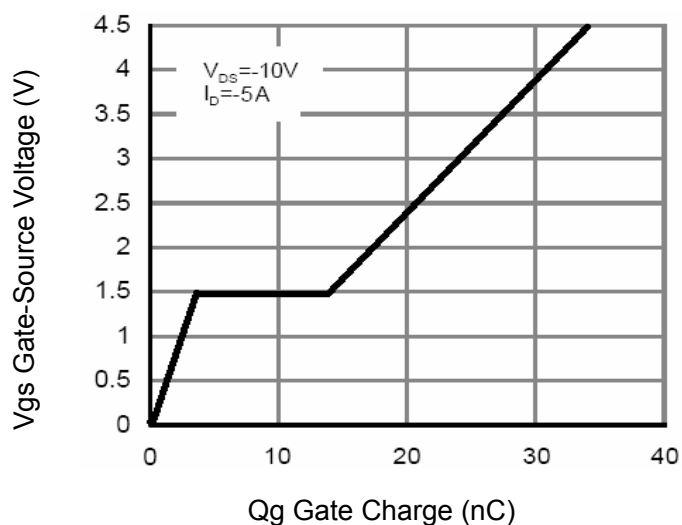
**Figure 8 Drain-Source On-Resistance**



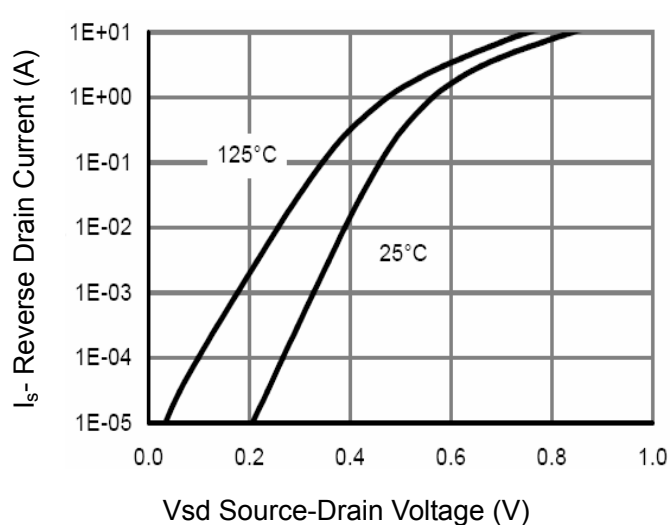
**Figure 9 Safe Operation Area**



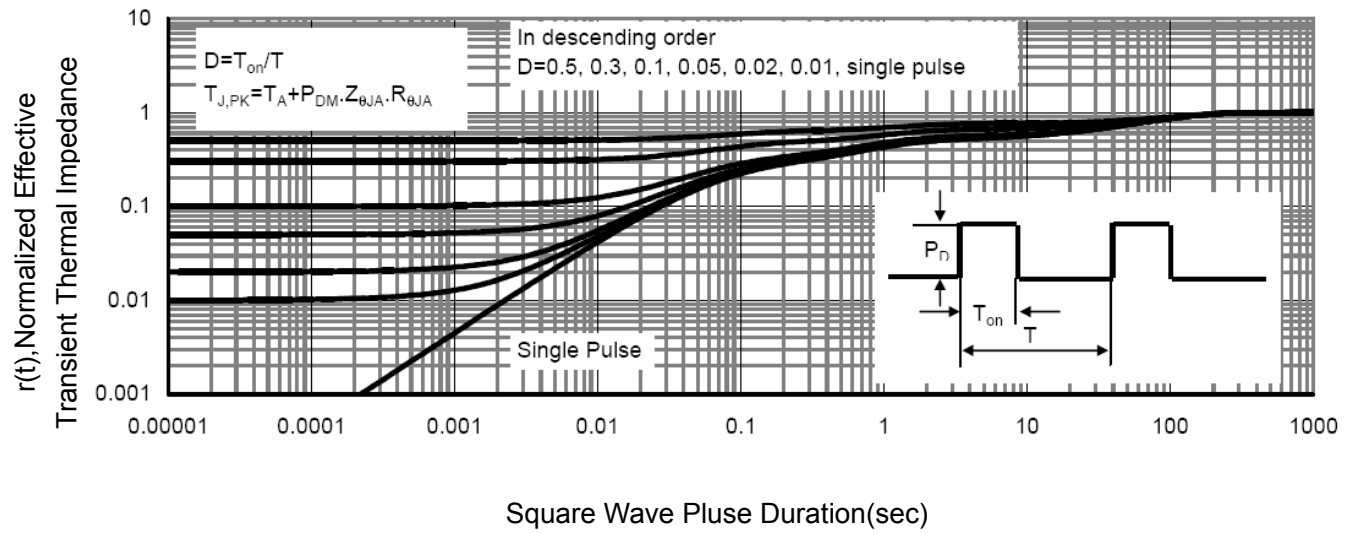
**Figure 10 Capacitance vs Vds**



**Figure 11 Gate Charge**

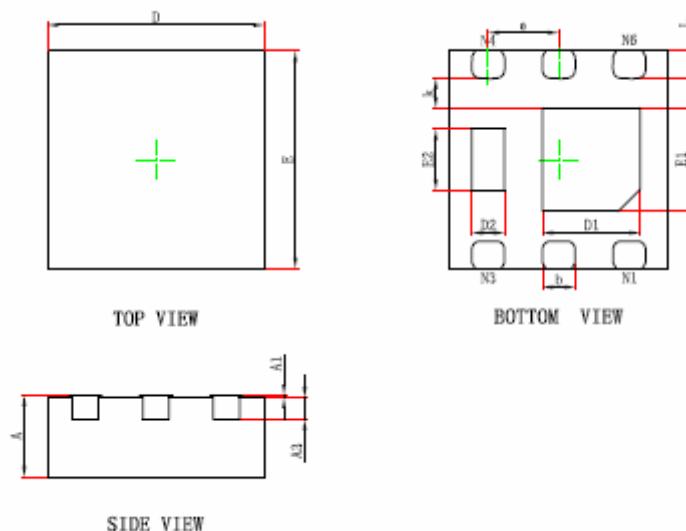


**Figure 12 Source- Drain Diode Forward**



**Figure 13 Normalized Maximum Transient Thermal Impedance**

## DFN2X2-6L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	1.924	2.076	0.076	0.082
E	1.924	2.076	0.076	0.082
D1	0.800	1.000	0.031	0.039
E1	0.850	1.050	0.033	0.041
D2	0.200	0.400	0.008	0.016
E2	0.460	0.660	0.018	0.026
k	0.200MIN.		0.008MIN.	
b	0.250	0.350	0.010	0.014
e	0.650TYP.		0.026TYP.	
L	0.174	0.326	0.007	0.013

## Notes

1. All dimensions are in millimeters.
2. Tolerance  $\pm 0.10\text{mm}$  (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.