

## N-Channel Enhancement Mode Power MOSFET

### Description

The HM11F6U uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

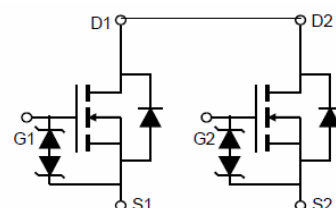
### General Features

- $V_{DS} = 20V, I_D = 10A$   
 $R_{DS(ON)} < 15m\Omega @ V_{GS} = 4.5V$   
 $R_{DS(ON)} < 16m\Omega @ V_{GS} = 2.5V$   
 $R_{DS(ON)} < 15m\Omega @ V_{GS} = 2.5V$

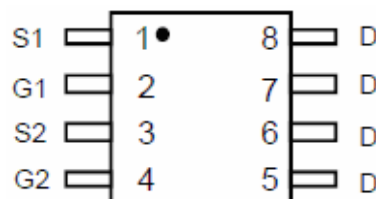
- High density cell design for ultra low  $R_{ds(on)}$
- Fully characterized avalanche voltage and current
- 2.5V Drive
- Common-drain type

### Application

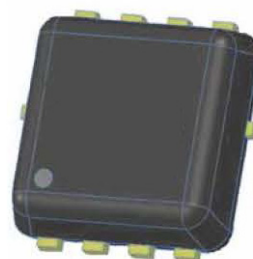
- Battery protection switch
- Mobile device battery charging and discharging



Schematic diagram



Pin Assignment



DFN 3x3 top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
HM11F6U	HM11F6U	DFN 3x3	-	-	-

### 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
Pulsed Drain Current	$I_{DM}$	32	A
Maximum Power Dissipation	$P_D$	1.5	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)	$R_{\theta JA}$	83	$^\circ C/W$
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**Electrical Characteristics (TC=25°C unless otherwise noted)**

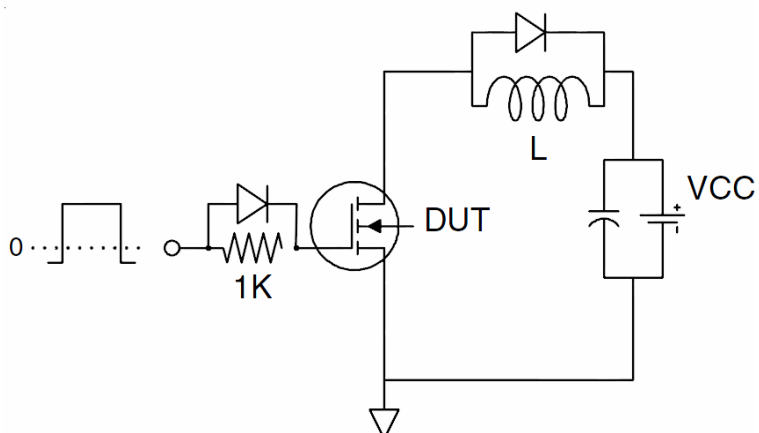
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	20		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =20V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±10V, V <sub>DS</sub> =0V	-	-	±10	μA
On Characteristics (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	0.5	-	1	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A	-	7.5	9.5	mΩ
		V <sub>GS</sub> =10V, I <sub>D</sub> =5A	-	8	10	
		V <sub>GS</sub> =10V, I <sub>D</sub> =10A	-	10	15	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =5A	5	-	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =10V, V <sub>GS</sub> =0V, F=1.0MHz	-	1255	-	PF
Output Capacitance	C <sub>oss</sub>		-	220	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	168	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =10V, I <sub>D</sub> =5A V <sub>GS</sub> =10V, R <sub>GEN</sub> =50Ω	-	300	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	1000	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	4000	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	2500	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =10A, V <sub>GS</sub> =10V	-	29	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	5.2	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	6.3	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =10A	-	0.85	1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	10	A

**Notes:**

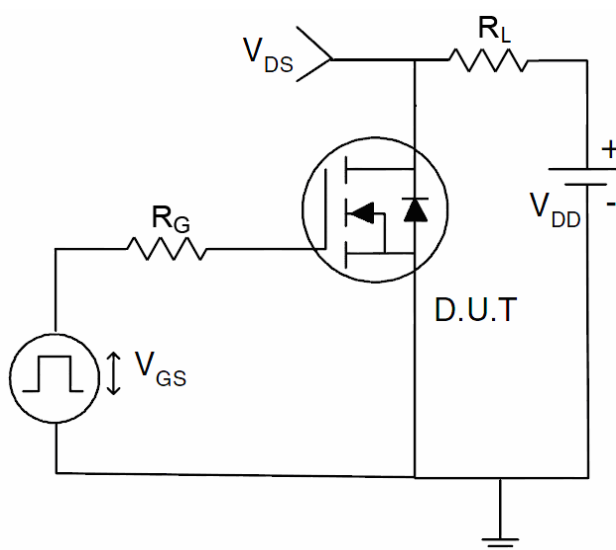
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

## Test Circuit

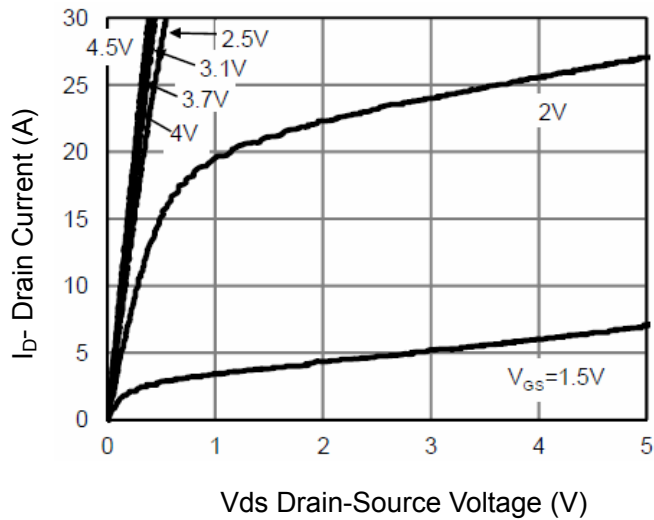
### 1) Gate Charge Test Circuit



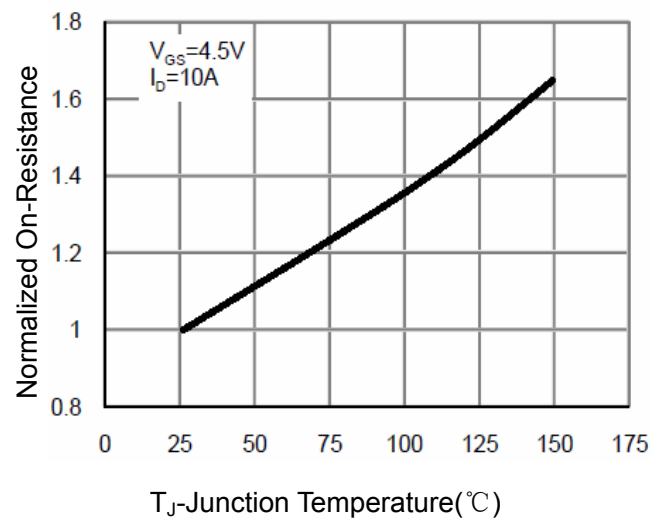
### 2) Switch Time Test Circuit



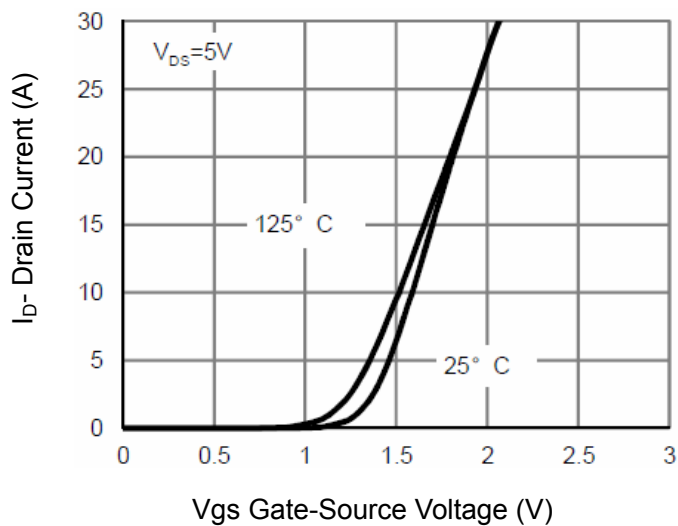
## Typical Electrical and Thermal Characteristics (Curves)



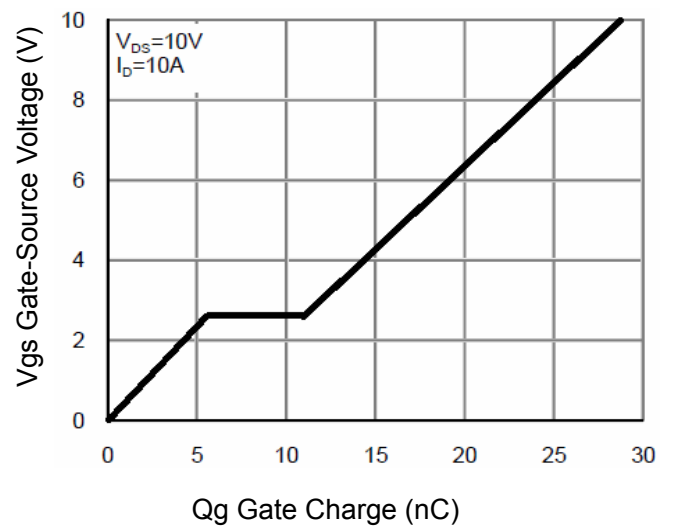
**Figure 1 Output Characteristics**



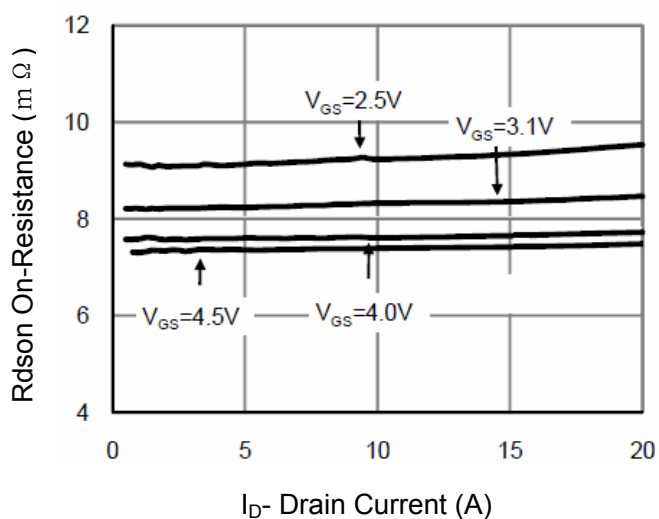
**Figure 4 Rdson-Junction Temperature**



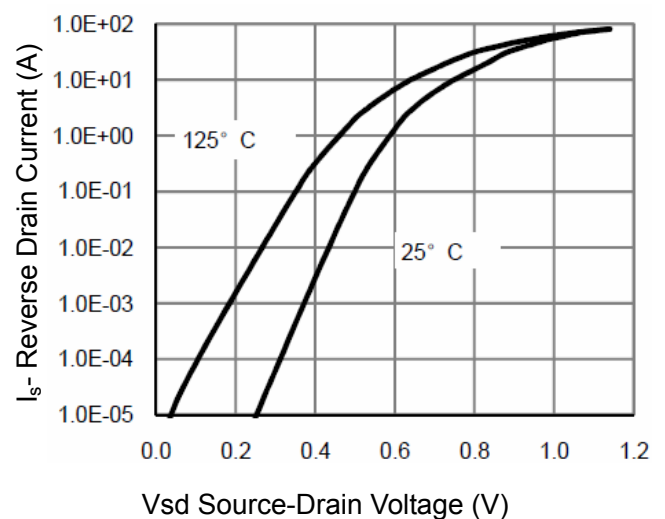
**Figure 2 Transfer Characteristics**



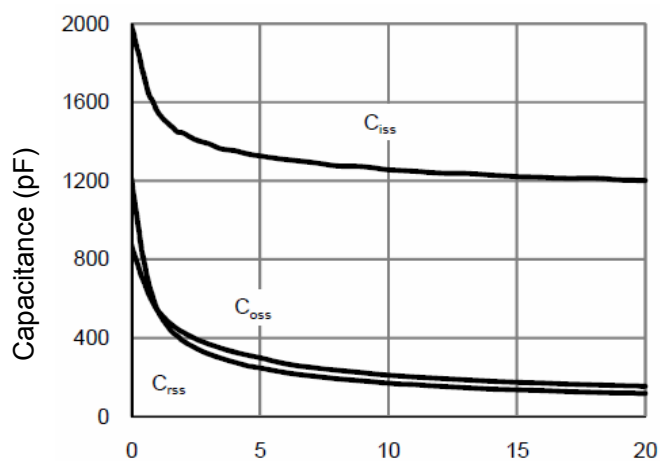
**Figure 5 Gate Charge**



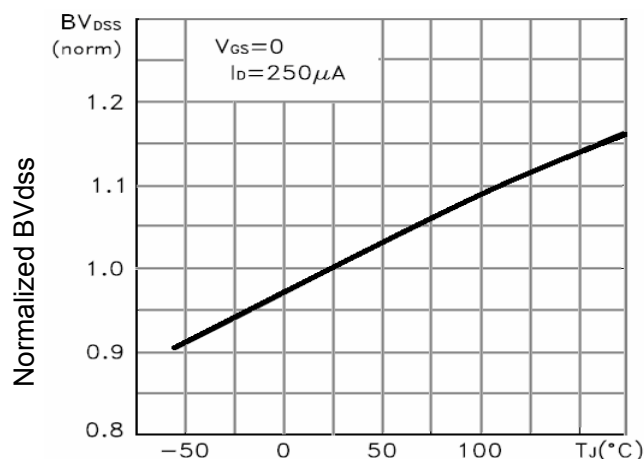
**Figure 3 Rdson- Drain Current**



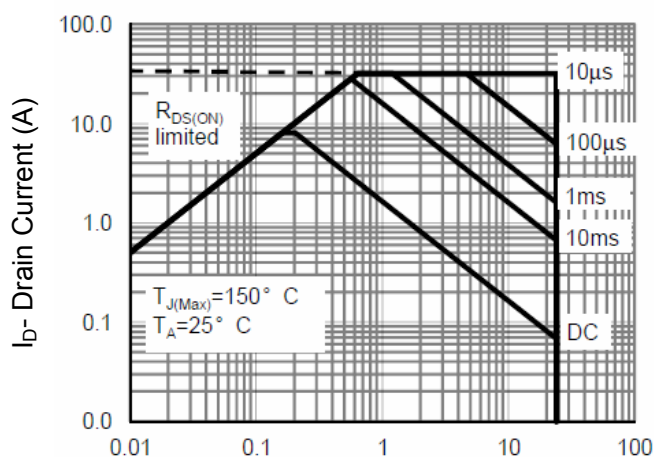
**Figure 6 Source- Drain Diode Forward**



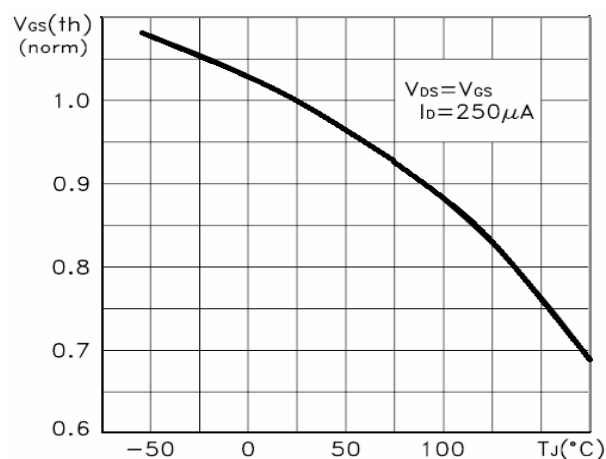
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



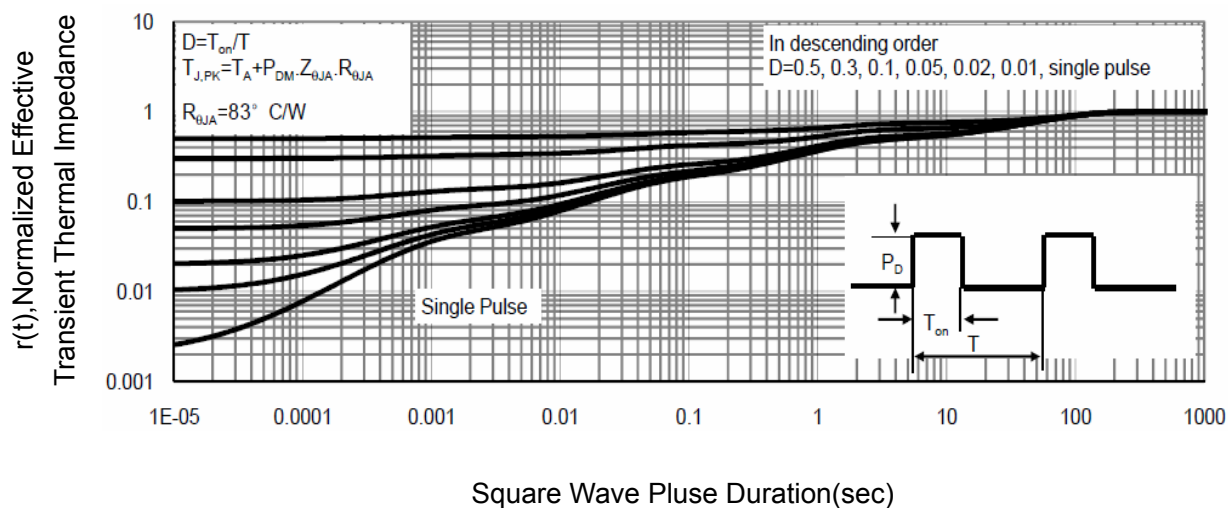
TJ-Junction Temperature(°C)  
**Figure 9 BV<sub>DSS</sub> vs Junction Temperature**



Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**

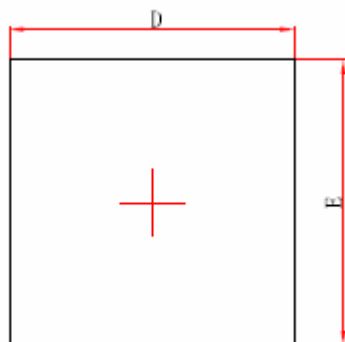


TJ-Junction Temperature(°C)  
**Figure 10 V<sub>GS(th)</sub> vs Junction Temperature**

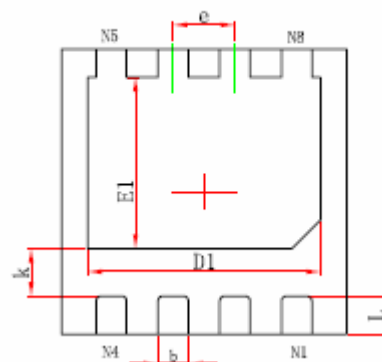


Square Wave Pluse Duration(sec)  
**Figure 11 Normalized Maximum Transient Thermal Impedance**

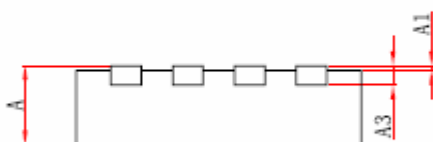
## DFN3X3 EP Package Information



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	2.924	3.076	0.115	0.121
E	2.924	3.076	0.115	0.121
D1	2.350	2.550	0.093	0.100
E1	1.700	1.900	0.067	0.075
k	0.450	0.550	0.018	0.022
b	0.270	0.370	0.011	0.015
e	0.650TYP.		0.026TYP.	
L	0.324	0.476	0.013	0.019

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