

# HMS11N65

## 650V N-Channel Super Junction MOSFET

### Features

- Very Low FOM ( $R_{DS(on)} \times Q_g$ )
- Extremely low switching loss
- Excellent stability and uniformity
- 100% Avalanche Tested
- Built-in ESD Diode

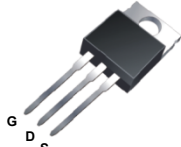
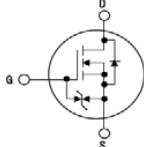
### Application

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- TV power & LED Lighting Power
- AC to DC Converters
- Telecom

### Key Parameters

Parameter	Value	Unit
$BV_{DSS} @T_{j,max}$	700	V
$I_D$	11	A
$R_{DS(on), max}$	0.38	$\Omega$
$Q_g, Typ$	22.6	nC

### Package & Internal Circuit

TO-220	SYMBOL
	

### Absolute Maximum Ratings

$T_C=25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain-Source Voltage	650	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	11	A
	Drain Current - Continuous ( $T_C = 100^\circ\text{C}$ )	7.7	A
$I_{DM}^{1)}$	Drain Current - Pulsed	33	A
$E_{AS}^{2)}$	Single Pulsed Avalanche Energy	133	mJ
$I_{AR}$	Avalanche Current	1.75	A
dv/dt	MOSFET dv/dt ruggedness, $V_{DS}=0 \dots 400\text{V}$	50	V/ns
dv/dt	Reverse diode dv/dt, $V_{DS}=0 \dots 400\text{V}$ , $I_{DS} \leq I_D$	15	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	91	W
$V_{ESD(G-S)}$	Gate source ESD(HBM-C=100pF, R=1.5K $\Omega$ )	2000	V
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Resistance Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.37	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	$^\circ\text{C/W}$

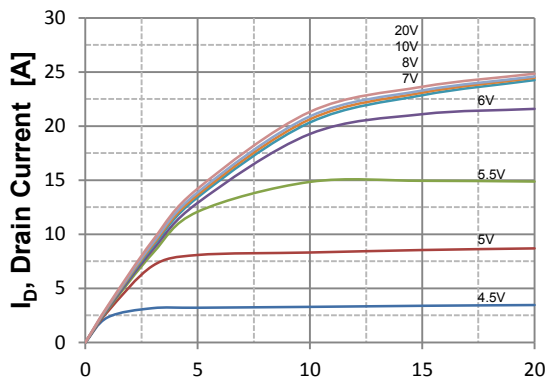
**Electrical Characteristics**  $T_J=25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
On Characteristics						
V <sub>GS</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 370 μA	2.0	-	4.0	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3.4 A	-	0.33	0.38	Ω
Off Characteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1mA	650	-	-	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 650 V, V <sub>GS</sub> = 0	-	-	1	μA
		V <sub>DS</sub> = 650 V, T <sub>C</sub> = 150°C	-	-	100	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V	-	-	±1	μA
Dynamic Characteristics						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	-	990	-	pF
C <sub>oss</sub>	Output Capacitance		-	25	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	2.5	-	pF
Switching Characteristics						
t <sub>d(on)</sub>	Turn-On Time	V <sub>DS</sub> = 325 V, I <sub>D</sub> = 4.8 A, R <sub>G</sub> = 25 Ω  (Note 3,4)	-	28	-	ns
t <sub>r</sub>	Turn-On Rise Time		-	20	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	114	-	ns
t <sub>f</sub>	Turn-Off Fall Time		-	17	-	ns
Q <sub>g(</sub>	Total Gate Charge	V <sub>DS</sub> = 520 V, I <sub>D</sub> = 4.8 A, V <sub>GS</sub> = 10 V  (Note 3,4)	-	22.6	-	nC
Q <sub>gs</sub>	Gate-Source Charge		-	4.6	-	nC
Q <sub>gd</sub>	Gate-Drain Charge		-	6.4	-	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		-	-	11	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		-	-	33	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 4.8 A	-	-	1.3	V
trr	Reverse Recovery Time	V <sub>R</sub> = 400 V, I <sub>F</sub> = 4.8 A di <sub>F</sub> /dt = 100 A/μs	-	250	-	ns
Qrr	Reverse Recovery Charge		-	2.6	-	μC

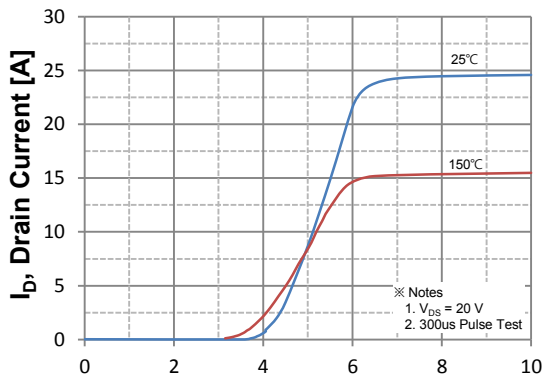
**Notes :**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $I_{AS}=1.75\text{A}, V_{DD}=50\text{V}, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
3. Pulse Test : Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
4. Essentially Independent of Operating Temperature

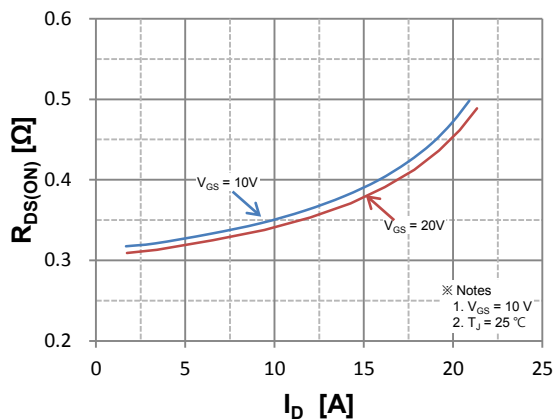
# Typical Characteristics



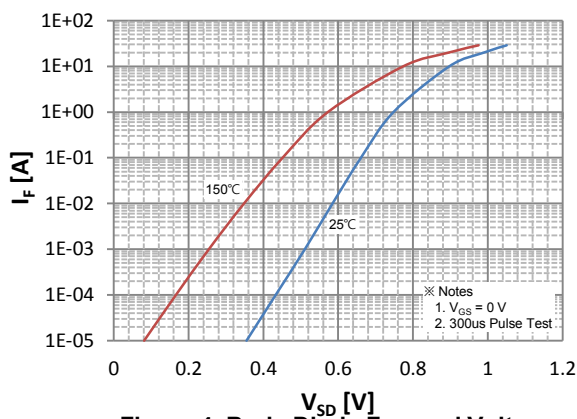
**Figure 1. On Region Characteristics**



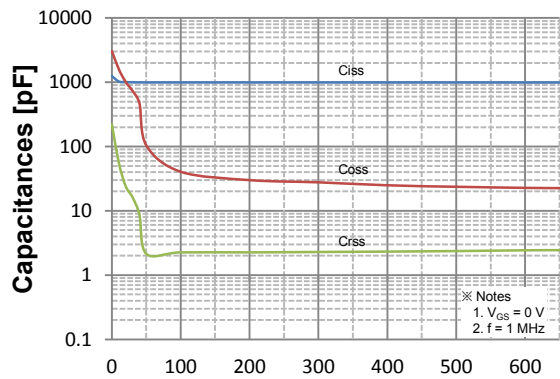
**Figure 2. Transfer Characteristics**



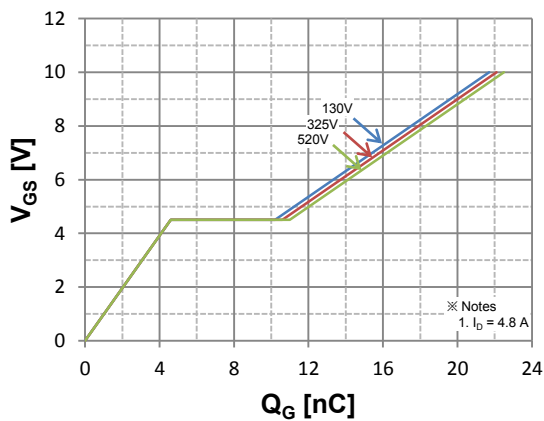
**Figure 3. On Resistance Variation vs Drain Current and Gate Voltage**



**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**

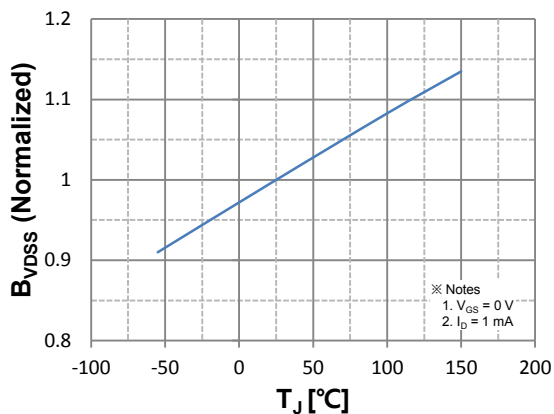


**Figure 5. Capacitance Characteristics**

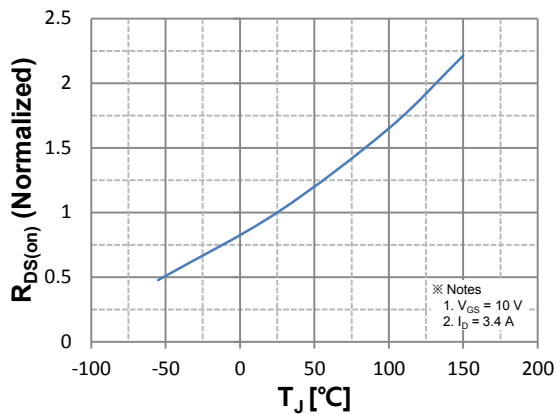


**Figure 6. Gate Charge Characteristics**

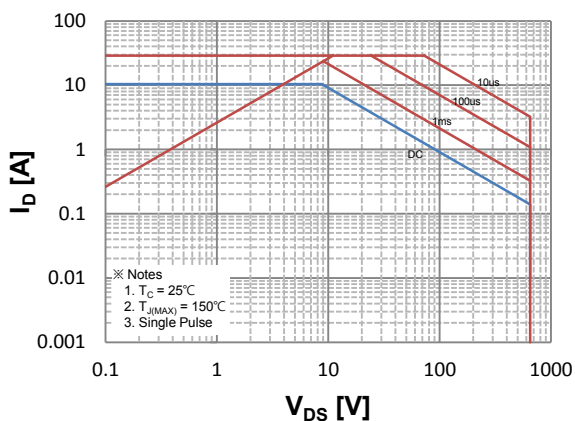
**Typical Characteristics (continued)**



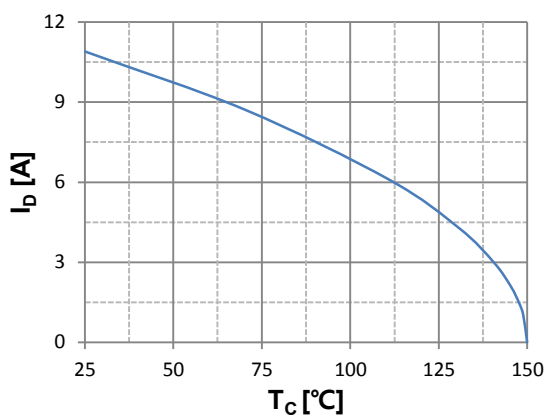
**Figure 7. Breakdown Voltage Variation vs. Temperature**



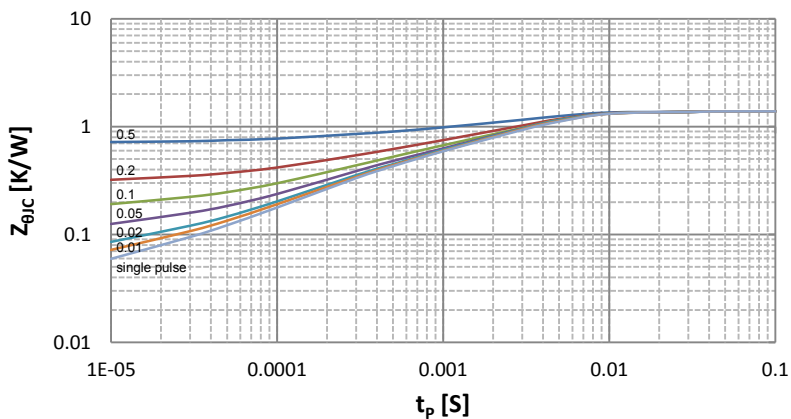
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**

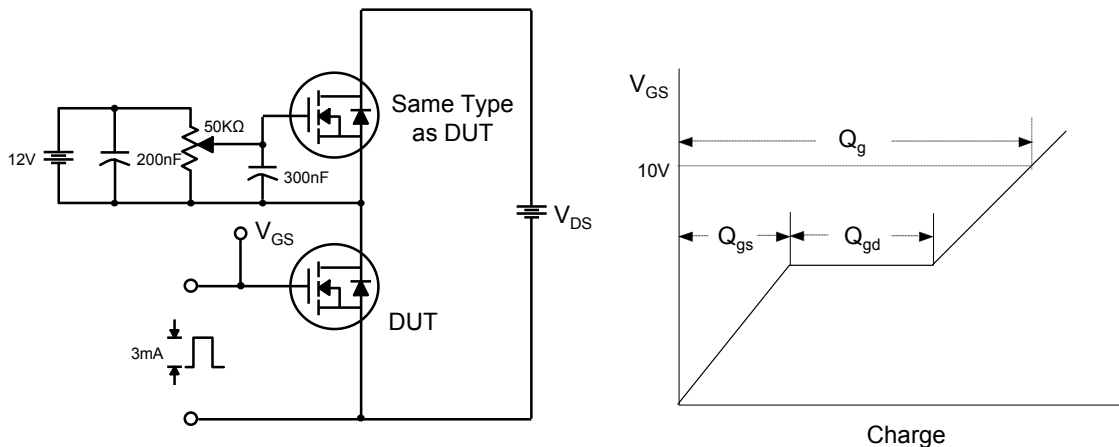


**Figure 10. Maximum Drain Current vs. Case Temperature**

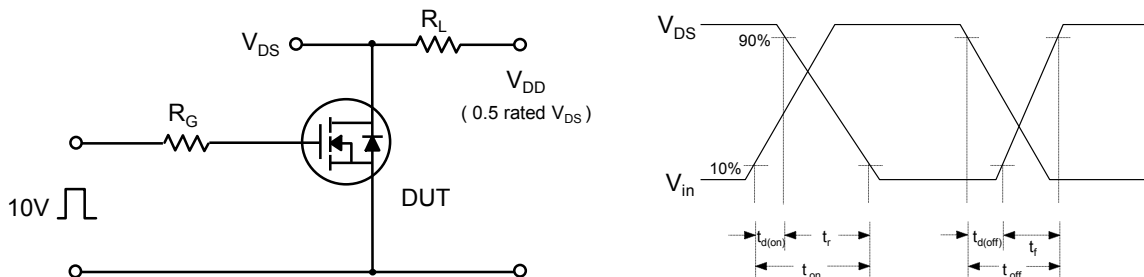


**Figure 11. Transient Thermal Response Curve**

**Fig 12. Gate Charge Test Circuit & Waveform**



**Fig 13. Resistive Switching Test Circuit & Waveforms**



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

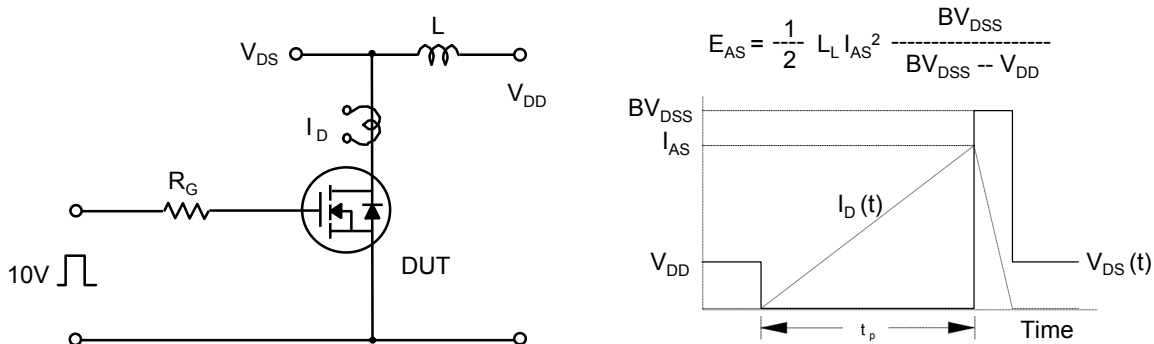
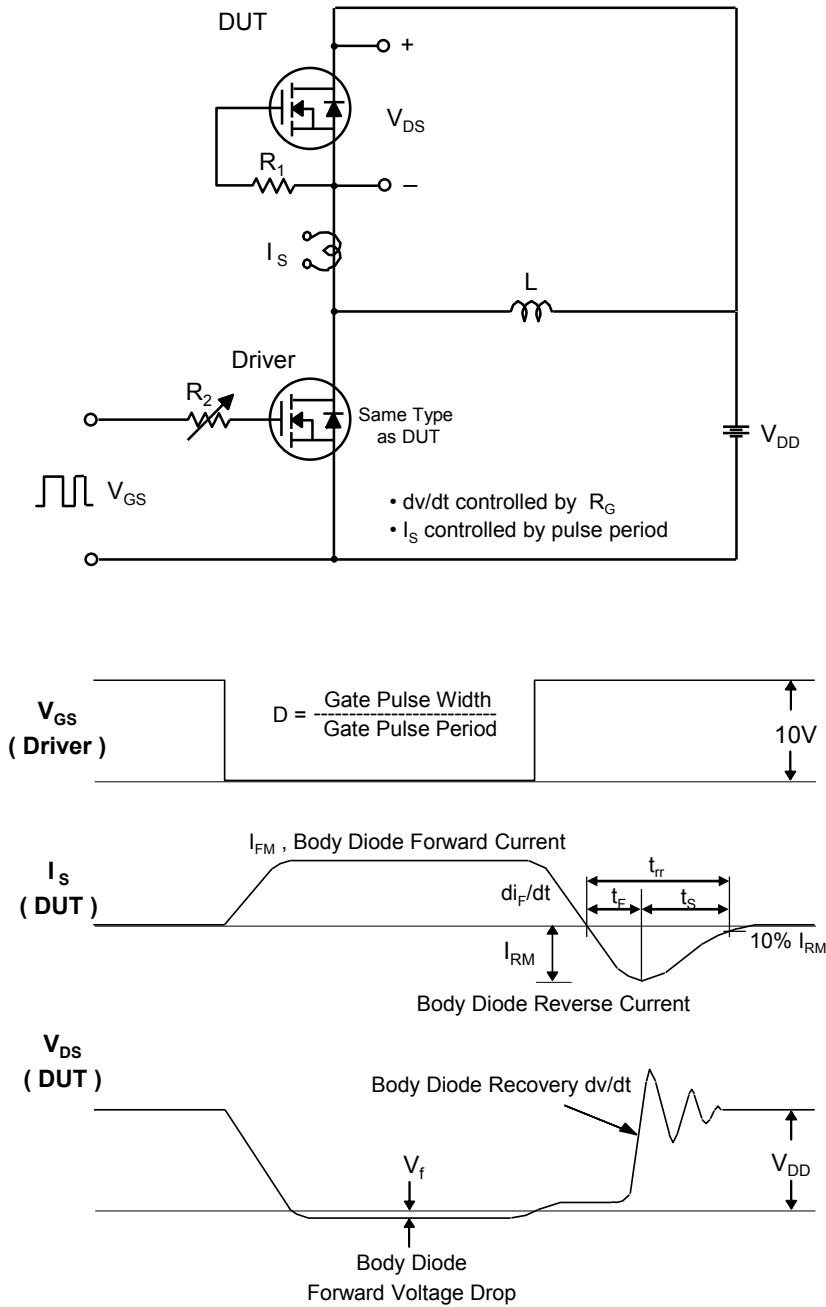


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



**Package Dimension**

**TO-220**

