

## N-Channel Super Trench Power MOSFET

### Description

The HMS65N04Q uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### Application

- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

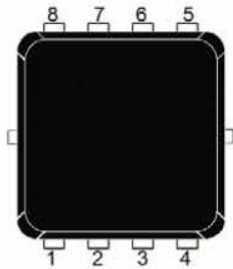
### General Features

- $V_{DS} = 40V, I_D = 65A$   
 $R_{DS(ON)} = 2.2m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 3.3m\Omega$  (typical) @  $V_{GS} = 4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating

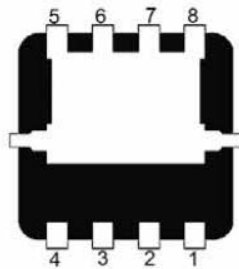
**100% UIS TESTED!**

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

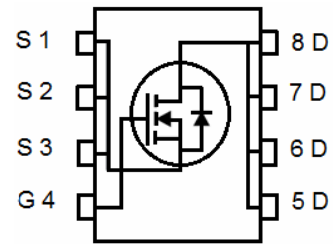
**DFN 3.3X3.3**



**Top View**



**Bottom View**



**Schematic Diagram**

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
HMS65N04Q	HMS65N04Q	DFN3.3X3.3-8L	-	-	-

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	65	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D (100^\circ C)$	45.5	A
Pulsed Drain Current	$I_{DM}$	260	A
Maximum Power Dissipation	$P_D$	55	W
Derating factor		0.44	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	500	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ C$

## Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	2.3	°C/W
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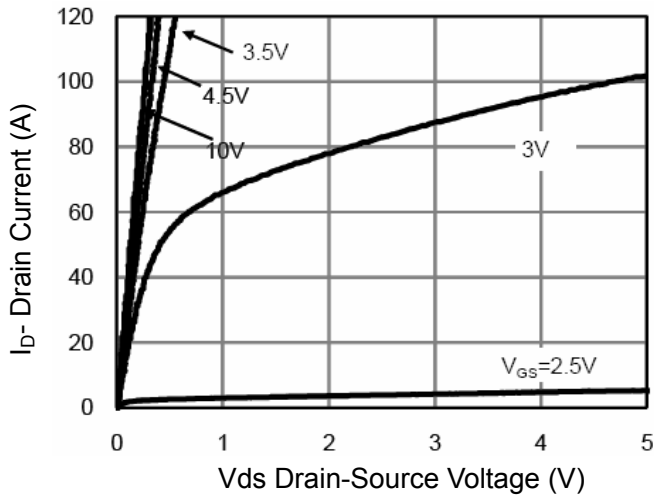
## Electrical Characteristics ( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

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	40		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =40V,V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V,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	1.0	1.5	2.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =20A	-	2.2	2.5	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A	-	3.3	3.8	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V,I <sub>D</sub> =20A		60	-	S
Dynamic Characteristics <sup>(Note4)</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =20V,V <sub>GS</sub> =0V, F=1.0MHz	-	2100	-	PF
Output Capacitance	C <sub>oss</sub>		-	773	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	15.5	-	PF
Switching Characteristics <sup>(Note 4)</sup>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =20V,I <sub>D</sub> =20A V <sub>GS</sub> =10V,R <sub>G</sub> =1.6Ω	-	7.5	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	4.0	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	37	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	7.5	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =20V,I <sub>D</sub> =20A, V <sub>GS</sub> =10V	-	34.8	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	6.2		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	5.1		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> =20A	-		1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>		-	-	65	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = I <sub>S</sub> di/dt = 100A/μs <sup>(Note3)</sup>	-	14	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	21	-	nC

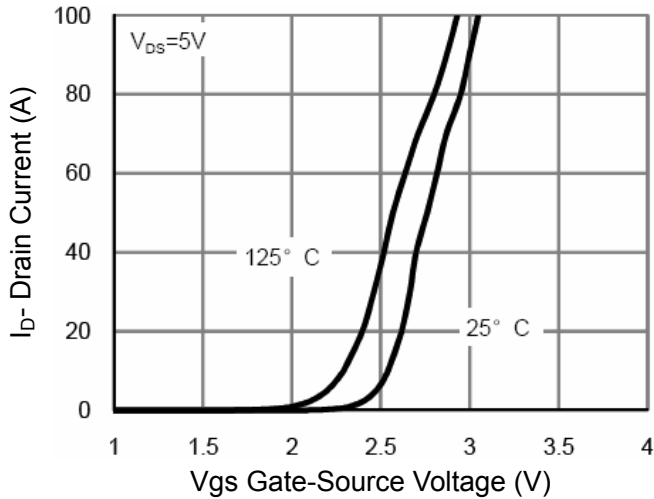
### Notes:

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
5. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=20V, V_G=10V, L=0.5mH, R_g=25\Omega$

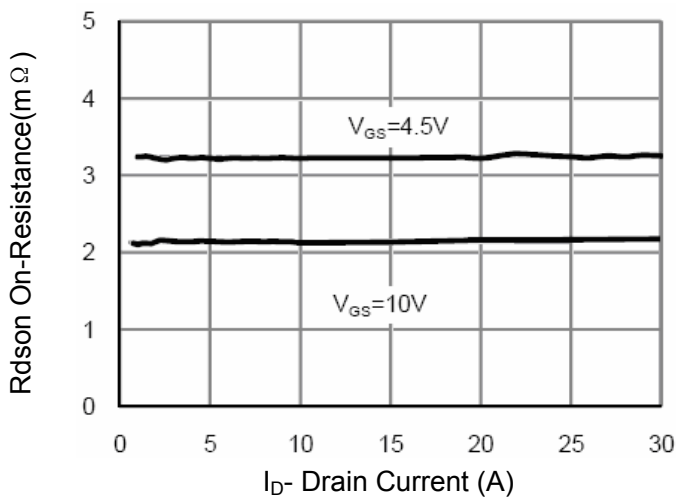
## Typical Electrical and Thermal Characteristics



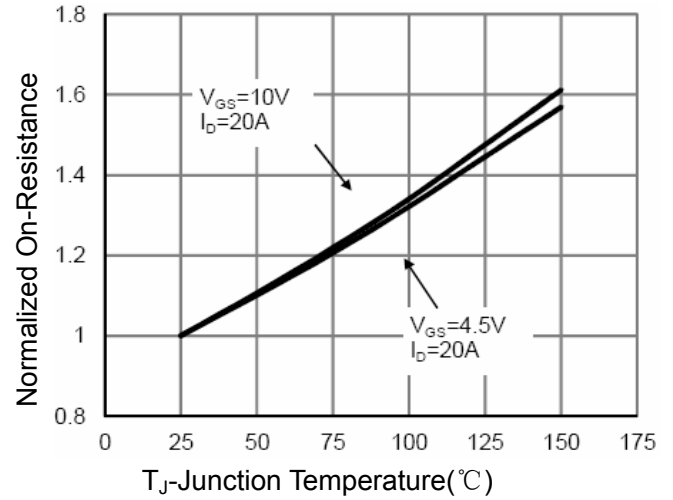
**Figure 1 Output Characteristics**



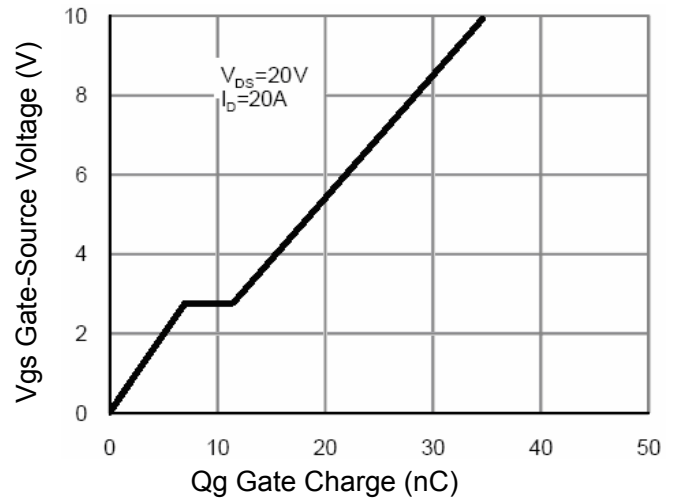
**Figure 2 Transfer Characteristics**



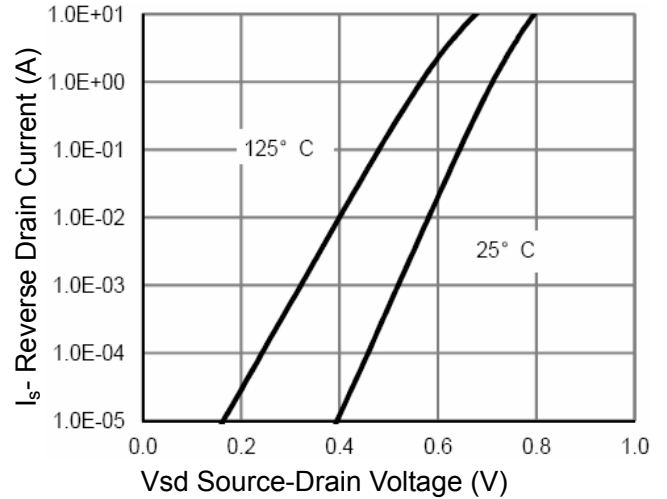
**Figure 3  $R_{DS(on)}$ - Drain Current**



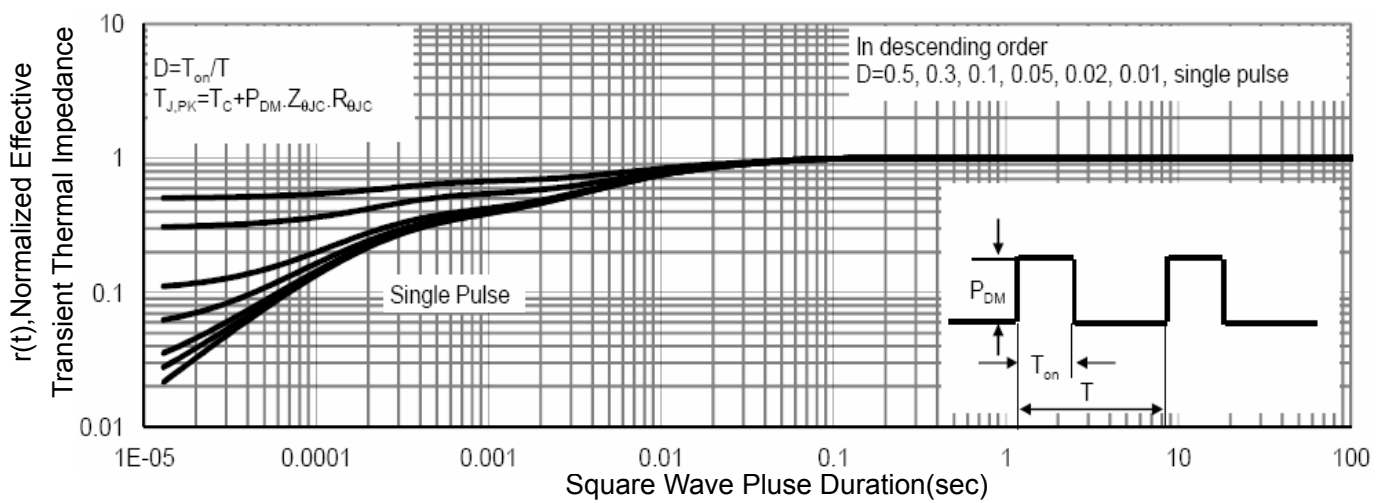
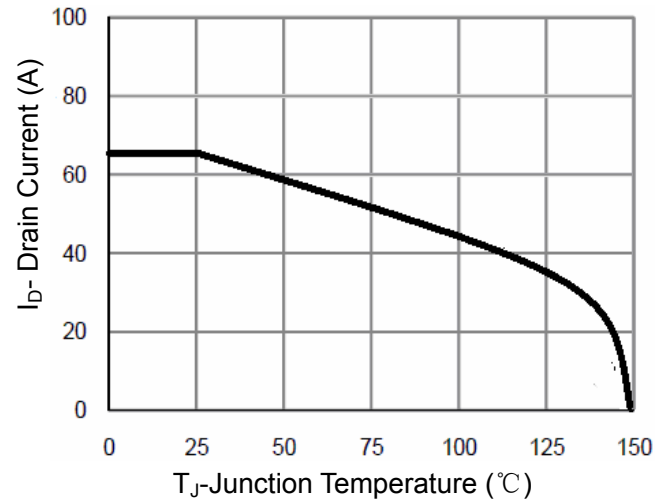
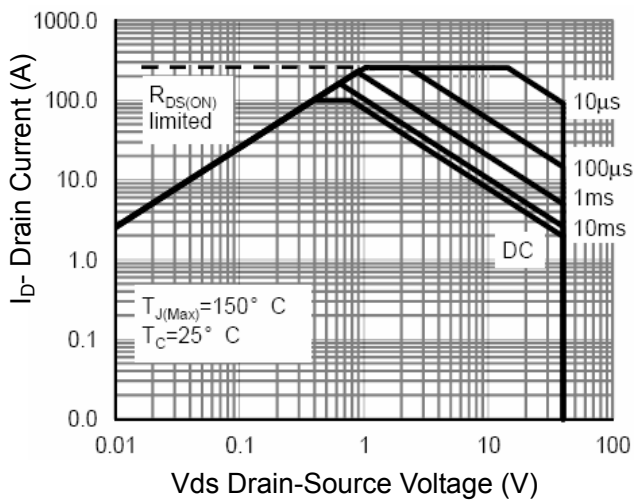
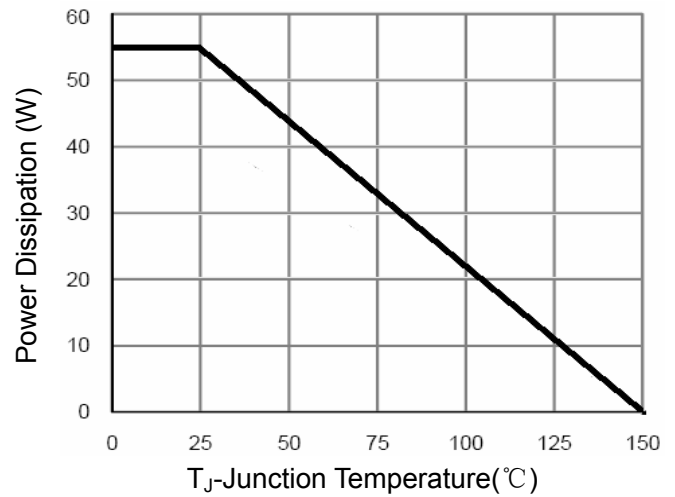
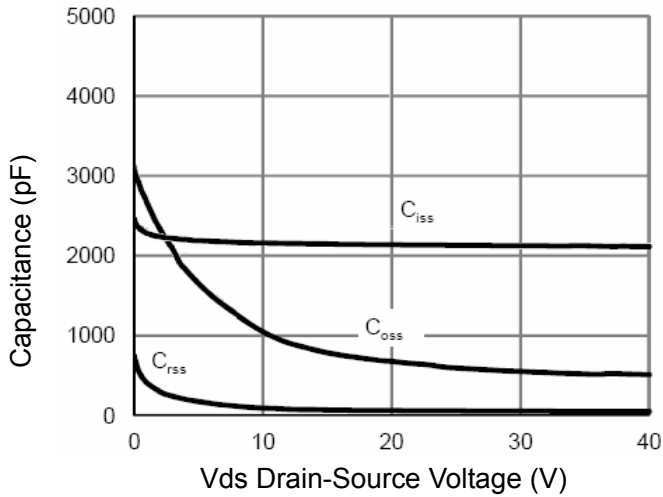
**Figure 4  $R_{DS(on)}$ -Junction Temperature**



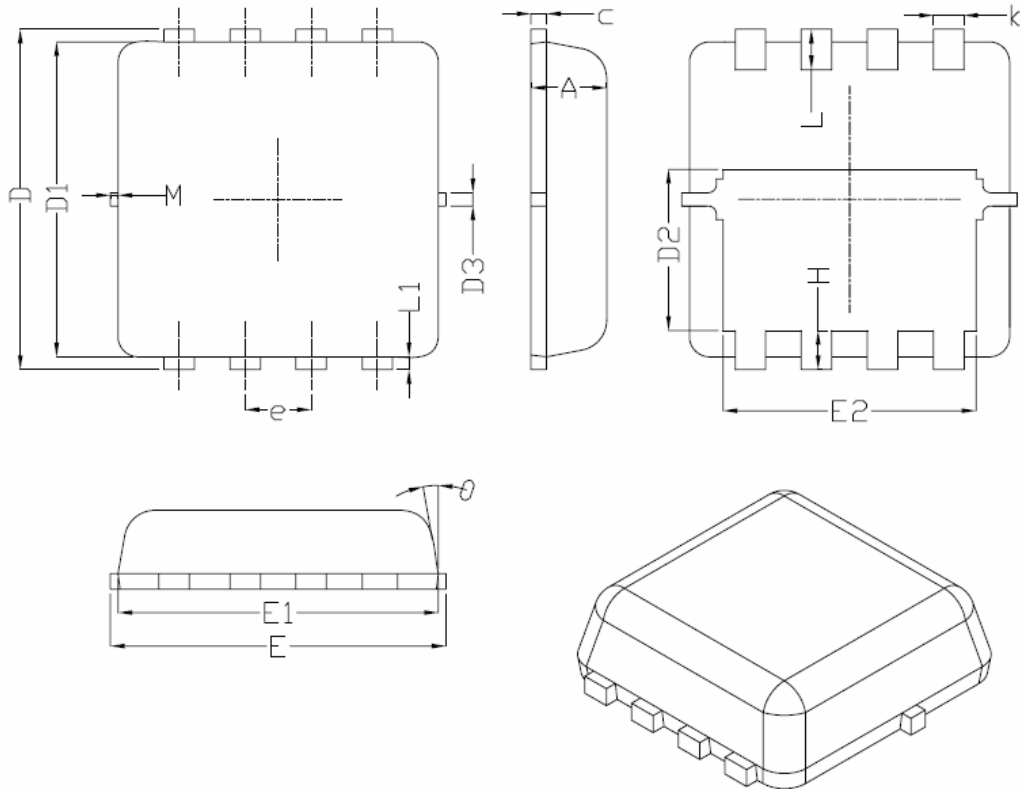
**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**



## DFN3.3X3.3-8L Package Information



Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	0.70	0.75	0.80
b	0.25	0.30	0.35
c	0.10	0.15	0.25
D	3.25	3.35	3.45
D1	3.00	3.10	3.20
D2	1.48	1.58	1.68
D3	-	0.13	-
E	3.20	3.30	3.40
E1	3.00	3.15	3.20
E2	2.39	2.49	2.59
e	0.65BSC		
H	0.30	0.39	0.50
L	0.30	0.40	0.50
L1	-	0.13	-
M	*	*	0.15
θ		10°	12°