

Description

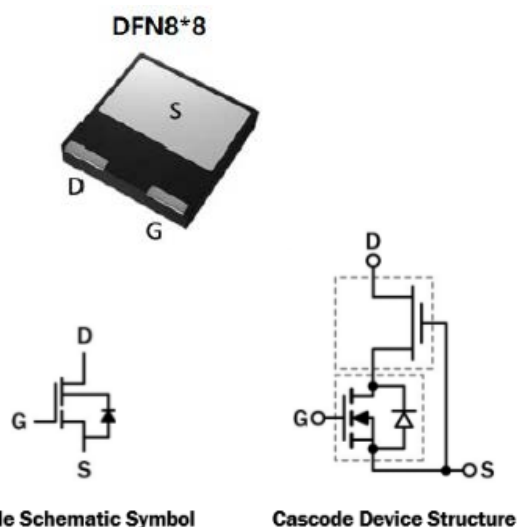
The HMN8N65D GaN FET is a normally-off Cascode device, it be based on a metal insulated high electron mobile transistor (MISHEMT) . It will offer increased noise immunity with a $\geq 1.5V$ threshold. H&M Semi GaN FET offers improved efficiency over silicon, through lower gate charge, lower crossover loss, and smaller reverse recovery charge.

Features

- 100% Dynamic $R_{DS(on)}$ production tested
- Typ. $R_{DS(on)} = 220m\Omega$
- Fast switching
- Ultra Low gate charge
- Wide gate safety margin
- Increased noise immunity

Applications

- Adaptor
- PV inverter
- Industrial SMPS



Key Specifications

| Symbol | Value | Unit |
|------------------|-------|-----------|
| $V_{DS,max}$ | 650 | V |
| $R_{DS(on),typ}$ | 220 | $m\Omega$ |
| I_D | 8 | A |
| $Q_{G,typ}$ | 18 | nC |
| $Q_{rr,typ}$ | 50 | nC |

Thermal Resistance

| Symbol | Parameter | Typical | Unit |
|-----------------|---------------------|---------|---------------|
| $R_{\theta JC}$ | Junction-to-Case | 4.5 | $^{\circ}C/W$ |
| $R_{\theta JA}$ | Junction-to-Ambient | 50 | $^{\circ}C/W$ |

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

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|-----------------|------|------|------|------|
|--------|-----------|-----------------|------|------|------|------|

Static Characteristics

| OFF Characteristics | | | | | | |
|---------------------|-----------------------------------|-------------------------------------------------|-----|----|------|---------------|
| V_{DSS} | Drain to Source Breakdown Voltage | $V_{GS}=0V$ | 650 | -- | -- | V |
| I_{DSS} | Drain to Source Leakage Current | $V_{DS}=650V, V_{GS}=0V, T_J=25^\circ\text{C}$ | -- | 6 | 10 | μA |
| | | $V_{DS}=650V, V_{GS}=0V, T_J=150^\circ\text{C}$ | -- | 18 | | μA |
| I_{GSS} | Gate to Source Forward Leakage | $V_{GS}=+20V$ | -- | -- | 100 | nA |
| | Gate to Source Reverse Leakage | $V_{GS}=-20V$ | -- | -- | -100 | nA |

| ON Characteristics | | | | | | |
|--------------------|-------------------------------|---------------------------------------------|----|------|----|------------------|
| $R_{DS(ON)}$ | Drain-to-Source On-Resistance | $V_{GS}=10V, I_D=8A, T_J=25^\circ\text{C}$ | -- | 220 | -- | $\text{m}\Omega$ |
| | | $V_{GS}=10V, I_D=8A, T_J=150^\circ\text{C}$ | -- | 420 | -- | $\text{m}\Omega$ |
| $V_{GS(TH)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}, I_D=250\mu\text{A}$ | -- | 1.65 | -- | V |

Dynamic Characteristics

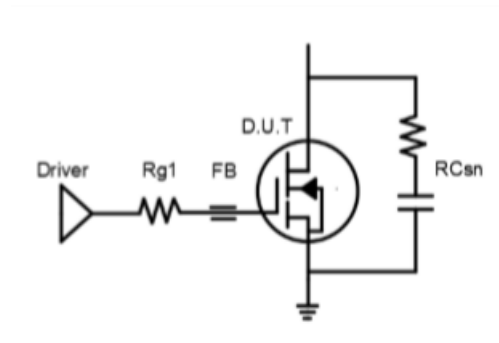
| Dynamic Characteristics | | | | | | |
|-------------------------|------------------------------|--------------------------------------|----|------|----|----|
| C_{iss} | Input Capacitance | $V_{GS}=0V, V_{DS}=650V$ $f=1MHz$ | -- | 1150 | -- | pF |
| C_{oss} | Output Capacitance | | -- | 25 | -- | |
| C_{rss} | Reverse Transfer Capacitance | | -- | 1 | -- | |

| Resistive Switching Characteristics | | | | | | |
|-------------------------------------|---------------------------------|-------------------------------------------------------------------------|----|-----|----|----|
| $t_{d(on)}$ | Turn-on Delay Time | $I_D=4A, V_{DS}=400V$ $R_G=10\Omega,$ $V_{GS}=0V \text{ to } 10V$ | -- | 30 | -- | ns |
| t_r | Rise Time | | -- | 12 | -- | |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 102 | -- | |
| t_f | Fall Time | | -- | 9 | -- | |
| Q_g | Total Gate Charge | $V_{GS}=0V \text{ to } 10V, I_D=4A,$ $V_{DS}=400V$ | -- | 20 | -- | nC |
| Q_{gs} | Gate to Source Charge | | -- | 4.5 | -- | |
| Q_{gd} | Gate to Drain ("Miller") Charge | | -- | 2.9 | -- | |

Reverse D Characteristics

| Source-Drain Diode Characteristics | | | | | | |
|------------------------------------|-------------------------|--------------------------------|----|----|-----|----|
| I_S | Reverse current | | -- | -- | 10 | A |
| V_{SD} | Reverse Voltage | $I_S=5A, V_{GS}=0V$ | -- | -- | 4.5 | V |
| t_{rr} | Reverse Recovery Time | $I_S=5A,$ $dI/dt=1125A/us,$ | -- | 11 | -- | ns |
| Q_{rr} | Reverse Recovery Charge | $V_{DD}=400V$ | -- | 50 | -- | nC |

Circuit Implementation



Recommended Gate Drive Circuit

Recommended gate drive:12V, with $R_{G(tot)}=34\Omega$, where $R_{G(tot)}=R_{g1}+R_{Driver}$

| Gate Ferrite Bead (FB) | Gate Resistance1 (R_{g1}) | RC Snubber (RC_{sn}) |
|------------------------|-------------------------------|--------------------------|
| MMZ1608S301ATA00 | 33 Ω | 22pF+15 Ω |

Notes:

- RC_{sn} should be placed as close as possible to the drain pin
- The layout and wiring of drive circuit should be as short as possible

Typical Characteristics Curve $T_c = 25^\circ\text{C}$ unless otherwise specified

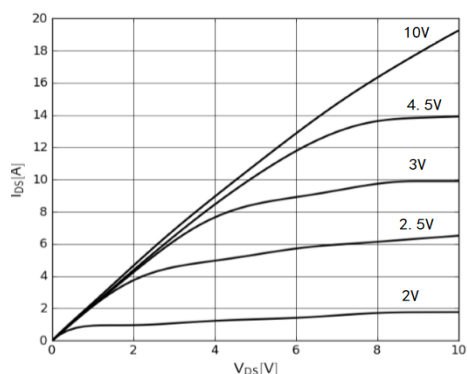


Figure 1. Typical Output Characteristics $T_j = 25^\circ\text{C}$
 $T_j = 150^\circ\text{C}$

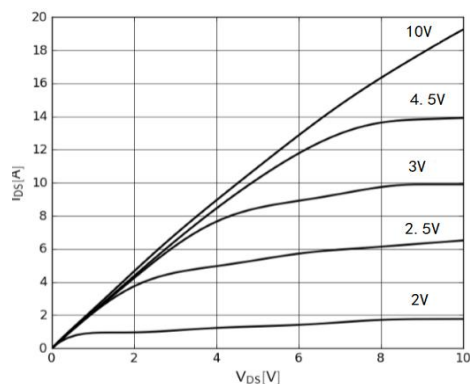


Figure 2. Typical Output Characteristics

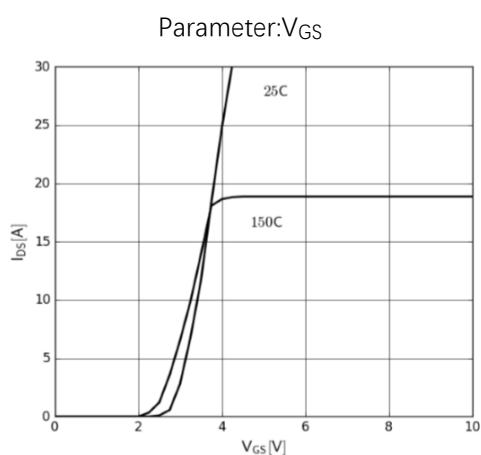


Figure 3. Typical Transfer Characteristics

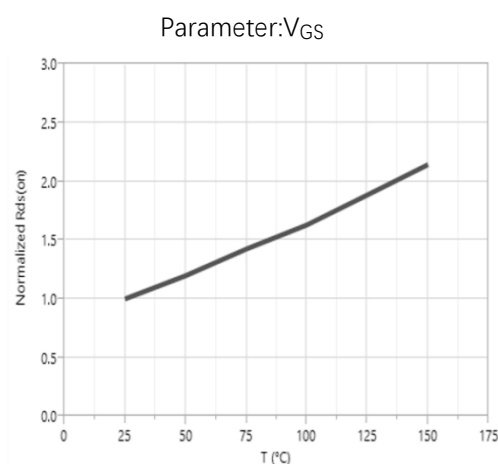


Figure 4. Normalized On-resistance

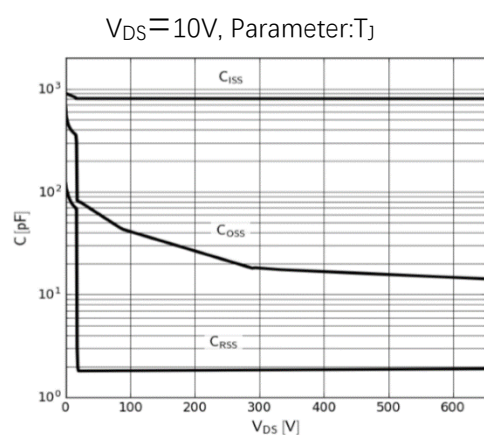


Figure 5. Typical Capacitance

$V_{GS} = 0\text{V}$, $f = 1\text{MHz}$

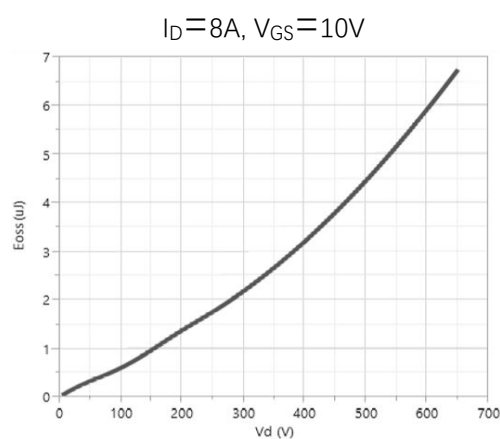


Figure 6. Typical Coss Stored Energy

Typical Characteristics Curve $T_c = 25^\circ\text{C}$ unless otherwise specified

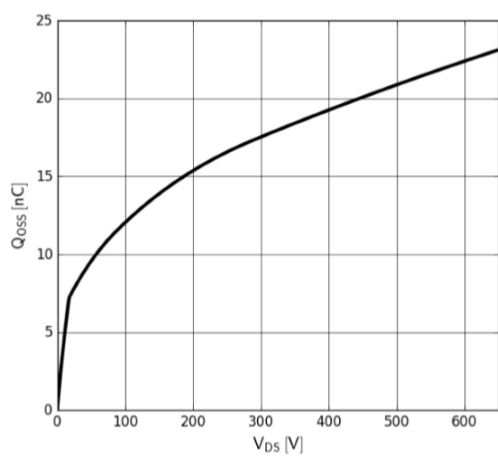


Figure 7. Typical Qoss

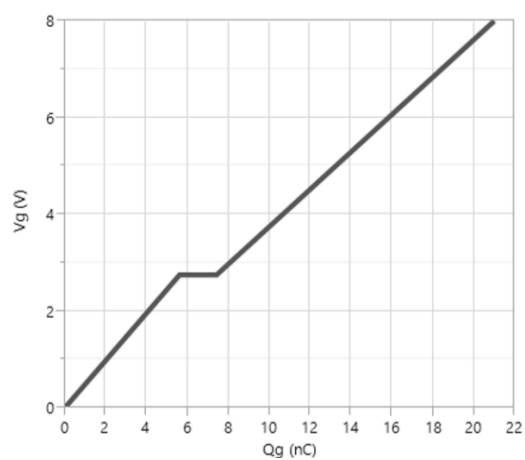


Figure 8. Typical Gate Charge

$I_{DS} = 4\text{A}$, $V_{DS} = 400\text{V}$

Test Circuits and Waveforms

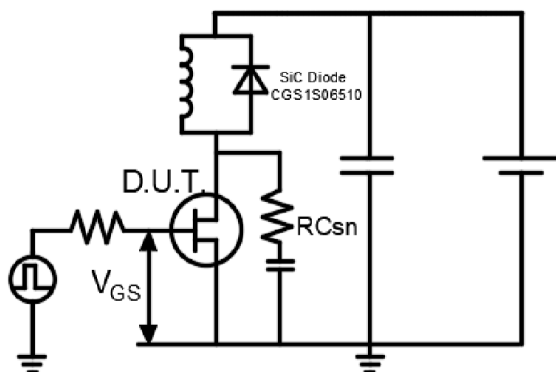


Figure 12. Switching Time Test Circuit

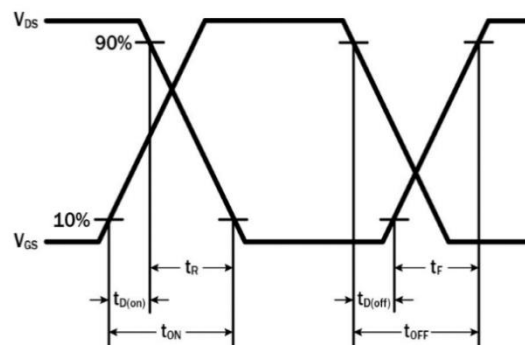


Figure 13. Switching Time Waveform

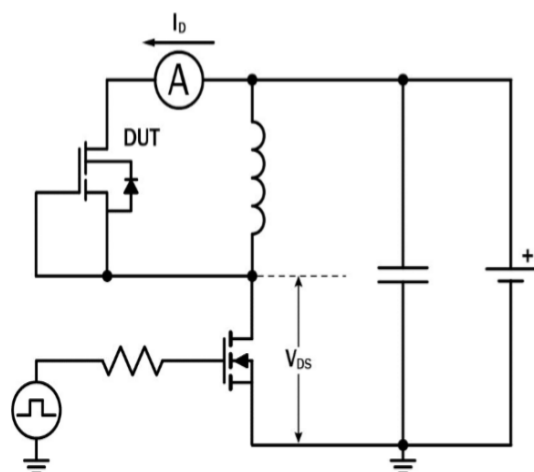


Figure 14. Diode Characteristics Test Circuit

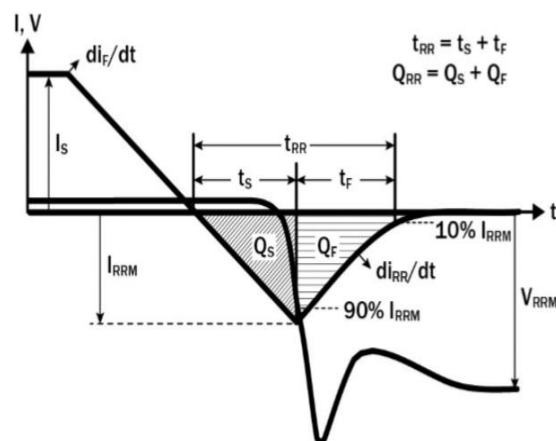


Figure 15. Diode Recovery Waveform

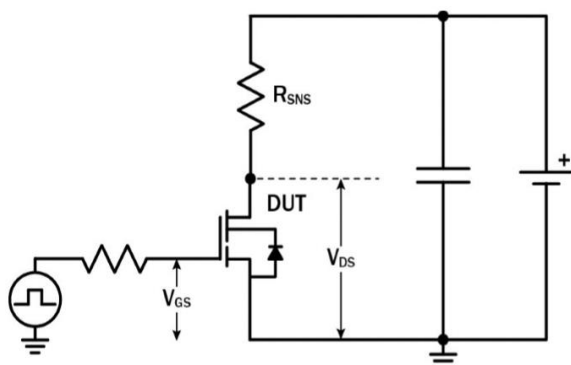


Figure 16. Dynamic $R_{DS(on)eff}$ Test Circuit

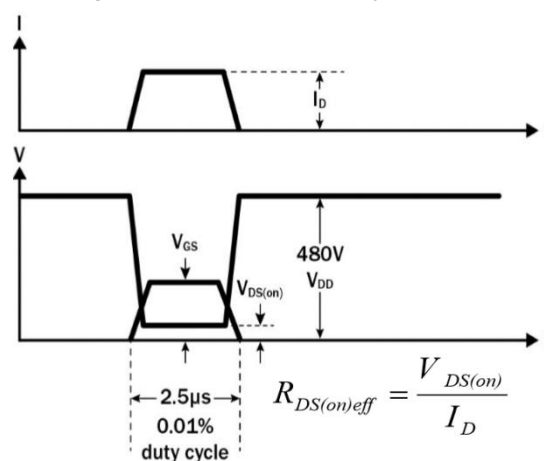
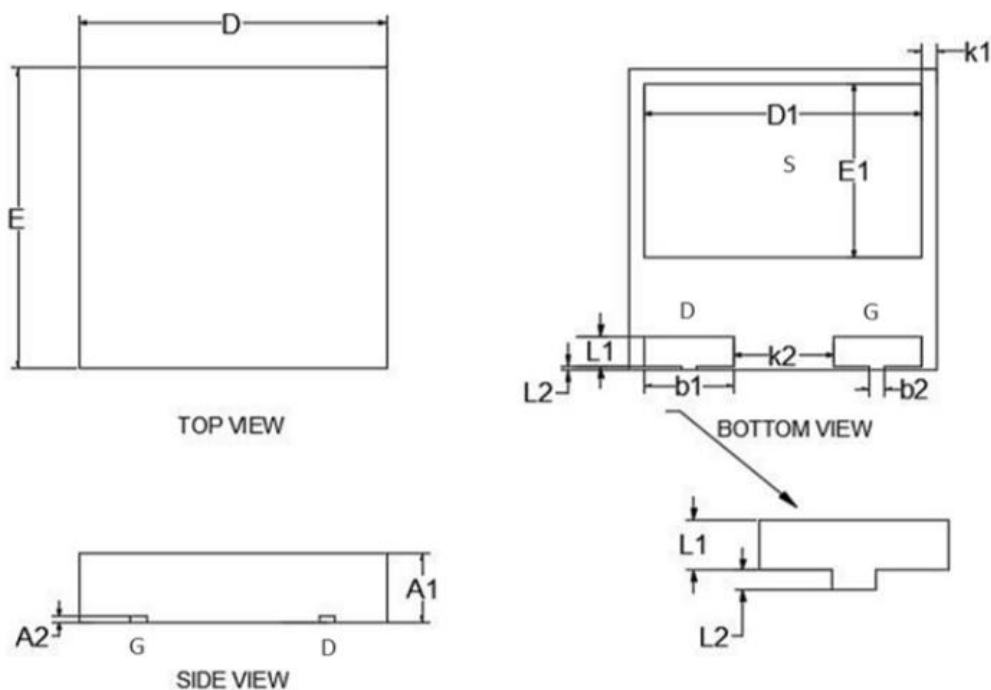


Figure 17. Dynamic $R_{DS(on)eff}$ Waveform

Mechanical Dimensions



DFN 8*8mm Package

| Items | Values(mm) | |
|-------|------------|-------|
| | MIN | MAX |
| A1 | 1.825 | 1.875 |
| A2 | 0.195 | 0.211 |
| D | 7.950 | 8.050 |
| E | 7.950 | 8.050 |
| D1 | 7.150 | 7.250 |
| E1 | 4.550 | 4.650 |
| K1 | 0.375 | 0.425 |
| K2 | 2.575 | 2.625 |
| b1 | 2.275 | 2.325 |
| b2 | 0.375 | 0.425 |
| L1 | 0.775 | 0.825 |
| L2 | 0.075 | 0.125 |

The name and content of poisonous and harmful material in products

| Part's Name | Hazardous Substance | | | | | | | | | |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | Pb | Hg | Cd | Cr (VI) | PBB | PBDE | DIBP | DEHP | DBP | BBP |
| Limit | ≤ 0.1% | ≤ 0.1% | ≤ 0.01% | ≤ 0.1% | ≤ 0.1% | ≤ 0.1% | ≤ 0.1% | ≤ 0.1% | ≤ 0.1% | ≤ 0.1% |
| Lead Frame | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Molding | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Chip | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Wire Bonding | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Solder | × | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Note | ○: Means the hazardous material is under the criterion of 2011/65/EU. ×: Means the hazardous material exceeds the criterion of 2011/65/EU. The plumbum element of solder exist in products presently, but within the allowed range of Eurogroup's RoHS. | | | | | | | | | |

Warnings

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. It is suggested to be used under 80 percent of the maximum ratings of the device.
2. When installing the heatsink, please pay attention to the torsional moment and the smoothness of the heatsink.
3. GaN FET is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. This publication is made by H&M Semi and subject to regular change without notice.