



H01N60 Series

N-Channel Power Field Effect Transistor

Description

This high voltage MOSFET uses an advanced termination scheme to provide enhanced voltage-blocking capability without degrading performance over time. In addition, this advanced MOSFET is designed to withstand high energy in avalanche and commutation modes. The new energy efficient design also offers a drain-to-source diode with a fast recovery time. Designed for high voltage, high speed switching applications in power supplies, converters and PWM motor controls, these devices are particularly well suited for bridge circuits where diode speed and commutating safe operating areas are critical and offer additional and safety margin against unexpected voltage transients.

Features

- 1A, 600V, $R_{DS(on)}=8\Omega@V_{GS}=10V$
- Low Gate Charge 15nC(Typ.)
- Low C_{iss} 4pF(Typ.)
- Fast Switching
- Improved d_v/d_t Capability

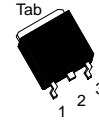
Absolute Maximum Ratings

| Symbol | Parameter | H01N60I / H01N60J | Units |
|----------------|---|-------------------|---------------|
| V_{DSS} | Drain-Source Voltage | 600 | V |
| I_D | Drain Current (Continuous $T_C=25^\circ C$) | 1 | A |
| | Drain Current (Continuous $T_C=100^\circ C$) | 0.6 | A |
| I_{DM} | Drain Current (Pulsed) *1 | 4 | A |
| V_{GS} | Gate-Source Voltage | ± 30 | V |
| E_{AS} | Single Pulse Avalanche Energy ($L=59mH, I_{AS}=1.1A, V_{DD}=50V, R_G=25\Omega, \text{Starting } T_J=25^\circ C$) | 50 | mJ |
| I_{AR} | Avalanche Current *1 | 1 | A |
| E_{AR} | Repetitive Avalanche Energy | 2.8 | mJ |
| dv/dt | Peak Diode Recovery dv/dt *2 | 4.5 | V/nS |
| V_{GS} | Gate-to-Source Voltage (Continue) | ± 20 | V |
| P_D | Total Power Dissipation ($T_A=25^\circ C$) | 2.5 | W |
| | Total Power Dissipation ($T_C=25^\circ C$) | 28 | W |
| | Derate above $25^\circ C$ | 0.22 | W/ $^\circ C$ |
| T_j, T_{stg} | Operating and Storage Temperature Range | -55 to +150 | $^\circ C$ |
| T_L | Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds | 300 | $^\circ C$ |

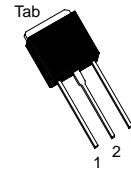
*1: Repetitive Rating : Pulse width limited by maximum junction temperature

*2: $I_{SD} \leq 1.1A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}, \text{Starting } T_J=25^\circ C$

H01N60 Series Pin Assignment

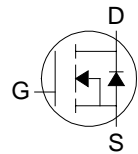


3-Lead Plastic **TO-252**
Package Code: J
Pin 1: Gate
Pin 2 & Tab: Drain
Pin 3: Source



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Thermal Characteristics

| Symbol | Parameter | Value | Units |
|-----------------|---|-------|-------|
| $R_{\theta JC}$ | Thermal Resistance Junction to Case Max. | 4.5 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient Max. | 110 | °C/W |

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

| Symbol | Characteristic | Min. | Typ. | Max. | Unit |
|--------|----------------|------|------|------|------|
|--------|----------------|------|------|------|------|

• Off Characteristics

| | | | | | |
|------------------------------|---|-----|-----|------|---------|
| V_{DSS} | Drain-Source Breakdown Voltage ($V_{GS}=0V, I_D=250\mu A$) | 600 | - | - | V |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient ($I_D=250\mu A$, Referenced to 25°C) | - | 0.6 | - | V/°C |
| I_{DSS} | Zero Gate Voltage Drain Current ($V_{DS}=600V, V_{GS}=0V$) | - | - | 1 | μA |
| | Zero Gate Voltage Drain Current ($V_{DS}=480V, T_J=125^\circ\text{C}$) | - | - | 50 | μA |
| I_{GSSF} | Gate-Body Leakage Current-Forward ($V_{GS}=30V, V_{DS}=0V$) | - | - | 100 | nA |
| I_{GSSR} | Gate-Body Leakage Current-Reverse ($V_{GS}=-30V, V_{DS}=0V$) | - | - | -100 | nA |

• On Characteristics

| | | | | | |
|--------------|--|---|------|---|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage ($V_{DS}=V_{GS}, I_D=250\mu A$) | 2 | - | 4 | V |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance ($V_{GS}=10V, I_D=0.6A$) ^{*3} | - | - | 8 | Ω |
| g_{FS} | Forward Transconductance ($V_{DS}=40V, I_D=0.5A$) ^{*3} | - | 0.75 | - | S |

• Dynamic Characteristics

| | | | | | | |
|------------|------------------------------|--|---|-----|-----|----|
| C_{iss} | Input Capacitance | $V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$ | - | 210 | 250 | pF |
| C_{oss} | Output Capacitance | | - | 19 | 25 | |
| C_{riss} | Reverse Transfer Capacitance | | - | 4 | 8 | |

• Switching Characteristics

| | | | | | | |
|--------------|---------------------|---|---|----|----|----|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}=300V, I_D=1.1A$ $R_G=25\Omega$ ^{*3} | - | - | 30 | ns |
| t_r | Turn-on Rise Time | | - | - | 60 | |
| $t_{d(off)}$ | Turn-off Delay Time | | - | - | 45 | |
| t_f | Turn-off Fall Time | | - | - | 75 | |
| Q_g | Total Gate Charge | $V_{DS}=480V, I_D=1.1A$ $V_{GS}=10V$ ^{*3} | - | 15 | 20 | nC |
| Q_{gs} | Gate-Source Charge | | - | 4 | - | |
| Q_{gd} | Gate-Drain Charge | | - | 3 | - | |

• Drain-Source Diode Characteristics and Maximum Ratings

| | | | | | |
|----------|---|---|------|-----|----|
| I_S | Maximum Continuous Drain-Source Diode Forward Current | - | - | 1 | A |
| I_{SM} | Maximum Pulsed Drain-Source Diode Forward Current | - | - | 4 | A |
| V_{SD} | Drain-Source Diode Forward Voltage ($V_{GS}=0V, I_S=1A$) | - | - | 1.4 | V |
| t_{rr} | Reverse Recovery Time ($V_{GS}=0V, I_S=1.1A, di_F/dt=100A/\mu s$) ^{*3} | - | 190 | - | ns |
| Q_{rr} | Reverse Recovery Charge ($V_{GS}=0V, I_S=1.1A, di_F/dt=100A/\mu s$) ^{*3} | - | 0.53 | - | nC |

*3: Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$



TO-252 Dimension

3-Lead TO-252 Plastic
Surface Mount Package
HSMC Package Code: J

Marking:

Pb Free Mark
 Pb-Free: "●" (Note)
 Normal: None

Date Code Control Code

Note: Green label is used for pb-free packing

Pin Style: 1.Gate 2.Drain 3.Source

Material:

- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

| DIM | Min. | Max. |
|-----|------|-------|
| A | 6.35 | 6.80 |
| C | 4.80 | 5.50 |
| F | 1.30 | 1.70 |
| G | 5.40 | 6.25 |
| H | 2.20 | 3.00 |
| L | 0.40 | 0.90 |
| M | 2.20 | 2.40 |
| N | 0.90 | 1.50 |
| a1 | 0.40 | 0.65 |
| a2 | - | *2.30 |
| a5 | 0.65 | 1.05 |

*: Typical, Unit: mm

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| DIM | Min. | Max. |
|-----|------|-------|
| A | 6.40 | 6.80 |
| B | - | 6.00 |
| C | 5.04 | 5.64 |
| D | - | *4.34 |
| E | 0.40 | 0.80 |
| F | 0.50 | 0.90 |
| G | 5.90 | 6.30 |
| H | 2.50 | 2.90 |
| I | 9.20 | 9.80 |
| J | 0.60 | 1.00 |
| K | - | 0.96 |
| L | 0.66 | 0.86 |
| M | 2.20 | 2.40 |
| N | 0.70 | 1.10 |
| O | 0.82 | 1.22 |
| a1 | 0.40 | 0.60 |
| a2 | 2.10 | 2.50 |
| y1 | - | 5° |
| y2 | - | 3° |

*: Typical, Unit: mm



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| DIM | Min. | Max. |
|-----|------|-------|
| A | 6.35 | 6.80 |
| C | 4.80 | 5.50 |
| F | 1.30 | 1.70 |
| G | 5.40 | 6.25 |
| H1 | 6.75 | 8.00 |
| K | 0.50 | 0.90 |
| K1 | 0.40 | 0.90 |
| L | 0.90 | 1.50 |
| M | 2.20 | 2.40 |
| a1 | 0.40 | 0.65 |
| a2 | - | *2.30 |

*: Typical, Unit: mm

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| C | 5.04 | 5.64 |
| D | - | *4.34 |
| E | 0.40 | 0.80 |
| F | 0.50 | 0.90 |
| G | 5.90 | 6.30 |
| H | - | *1.80 |
| H1 | - | *9.30 |
| I | - | *16.10 |
| J | - | *0.80 |
| K | - | 0.96 |
| K1 | - | *0.76 |
| M | 2.20 | 2.40 |
| a1 | 0.40 | 0.60 |
| a2 | 2.10 | 2.50 |
| y1 | - | 5° |
| y2 | - | 3° |

*: Typical, Unit: mm

3-Lead TO-251
 Plastic Package
 HSMC Package Code: I

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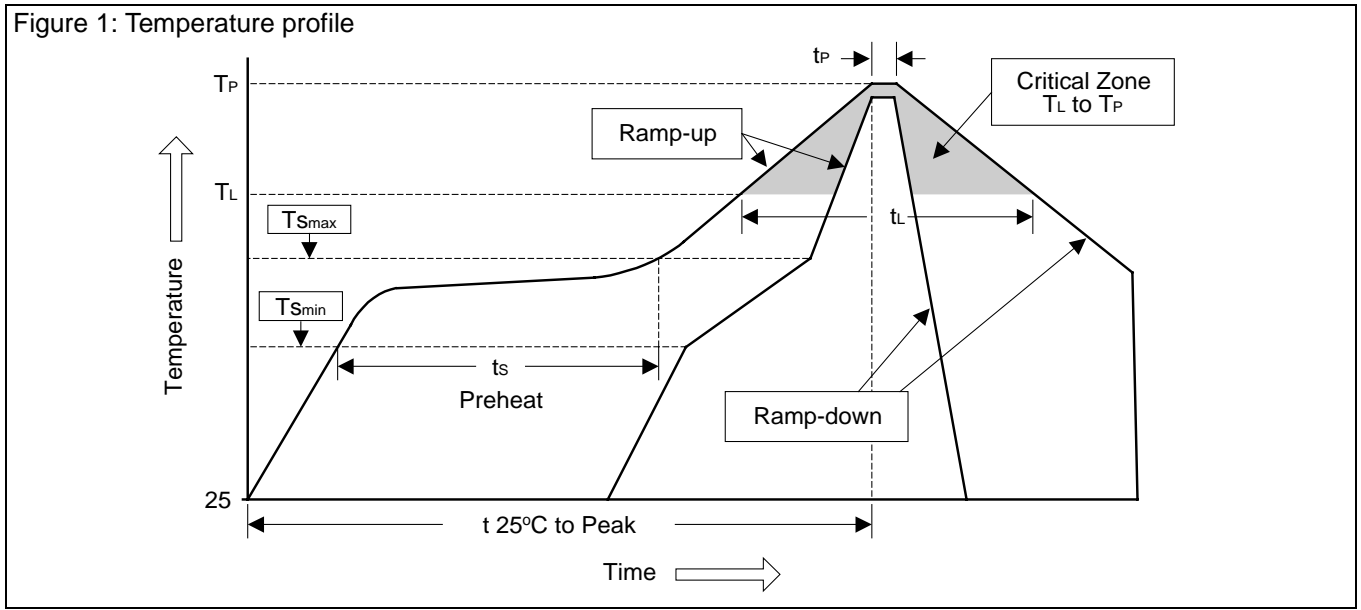
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Soldering Methods for HSMC's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



| Profile Feature | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|--|-------------------------|------------------|
| Average ramp-up rate (T_L to T_P) | <3°C/sec | <3°C/sec |
| Preheat | | |
| - Temperature Min (T_{smin}) | 100°C | 150°C |
| - Temperature Max (T_{smax}) | 150°C | 200°C |
| - Time (min to max) (t_s) | 60~120 sec | 60~180 sec |
| T_{smax} to T_L | | |
| - Ramp-up Rate | <3°C/sec | <3°C/sec |
| Time maintained above: | | |
| - Temperature (T_L) | 183°C | 217°C |
| - Time (t_L) | 60~150 sec | 60~150 sec |
| Peak Temperature (T_P) | 240°C +0/-5°C | 260°C +0/-5°C |
| Time within 5°C of actual Peak Temperature (t_P) | 10~30 sec | 20~40 sec |
| Ramp-down Rate | <6°C/sec | <6°C/sec |
| Time 25°C to Peak Temperature | <6 minutes | <8 minutes |

3. Flow (wave) soldering (solder dipping)

| Products | Peak temperature | Dipping time |
|------------------|------------------|--------------|
| Pb devices. | 245°C ±5°C | 5sec ±1sec |
| Pb-Free devices. | 260°C +0/-5°C | 5sec ±1sec |