# HIRF740 / HIRF740F

N-Channel Power MOSFET (400V, 10A)

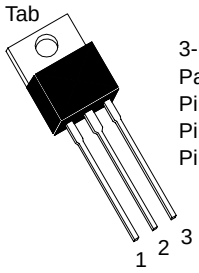
## Description

This N-Channel MOSFETs provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

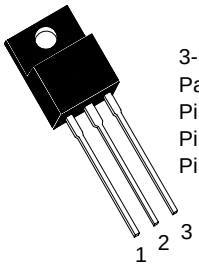
## Features

- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements

HIRF740 Series Pin Assignment

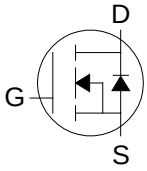



3-Lead Plastic **TO-220AB**
Package Code: E
Pin 1: Gate
Pin 2 & Tab: Drain
Pin 3: Source




3-Lead Plastic **TO-220FP**
Package Code: F
Pin 1: Gate
Pin 2: Drain
Pin 3: Source

HIRF740 Series Symbol




## Thermal Characteristics

| Symbol | Parameter | Value | | Units |
|---|---|---|---|---|
| $R\theta_{JC}$ | Thermal Resistance Junction to Case Max. | TO-220AB | 1.71 | °C/W |
| | | TO-220FP | 3.3 | |
| $R\theta_{JA}$ | Thermal Resistance Junction to Ambient Max. | 62 | | °C/W |

## Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | 400 | V |
| $I_D$ | Drain to Current (Continuous)($V_{GS}$@10V, $T_C$=25°C) | 10 | A |
| | Drain to Current (Continuous)($V_{GS}$@10V, $T_C$=100°C) | 6.3 | A |
| $I_{DM}$ | Drain to Current (Pulsed)[*1] | 40 | A |
| $V_{GS}$ | Gate-to-Source Voltage (Continue) | ±20 | V |
| $P_D$ | Total Power Dissipation<br>TO-220AB<br>TO-220FP | <br>74<br>38 | W |
| | Derate above 25°C<br>TO-220AB<br>TO-220FP | <br>0.59<br>0.3 | W/°C |
| $E_{AS}$ | Single Pulse Avalanche Energy[*2] | 520 | mJ |
| $I_{AR}$ | Avalanche Current[*1] | 10 | A |
| $E_{AR}$ | Repetitive Avalanche Energy[*1] | 13 | mJ |
| $d_v/d_t$ | Peak Diode Recovery[*3] | 4 | V/ns |
| $T_J$,$T_{stg}$ | Operating Junction and Storage Temperature Range | -55 to 150 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering Purposes, 1.6mm from case for 10 seconds | 300 | °C |

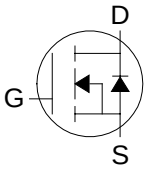
*1: Repetitive rating; pulse width limited by max. junction temperature
*2: $V_{DD}$=50V, starting $T_j$=25°C, L=9.1mH, $R_G$=25Ω, $I_{AS}$=10A
*3: $I_{SD}$≤10A, di/dt≤120A/us, $V_{DD}$≤$V_{(BR)DSS}$, $T_J$≤150°C

## ELectrical Characteristics ($T_j$=25°C, unless otherwise specified)

| Symbol | Characteristic | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage ($V_{GS}$=0V, $I_D$=250uA) | | 400 | - | - | V |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient (Reference to 25°C, $I_D$=1mA) | | - | 0.49 | - | V/°C |
| $I_{DSS}$ | Drain-Source Leakage Current ($V_{DS}$=400V, $V_{GS}$=0V) | | - | - | 25 | uA |
| | Drain-Source Leakage Current ($V_{DS}$=320V, $V_{GS}$=0V, $T_j$=125°C) | | | | 250 | uA |
| $I_{GSSF}$ | Gate-Source Leakage Current-Forward ($V_{gsf}$=20V, $V_{DS}$=0V) | | - | - | 100 | nA |
| $I_{GSSR}$ | Gate-Source Leakage Current-Reverse ($V_{gsr}$=-20V, $V_{DS}$=0V) | | - | - | -100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage ($V_{DS}$=$V_{GS}$, $I_D$=250uA) | | 2 | - | 4 | V |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance ($V_{GS}$=10V, $I_D$=6A)*4 | | - | - | 0.55 | Ω |
| $g_{FS}$ | Forward Transconductance ($V_{DS}$=50V, $I_D$=6A)*4 | | 5.8 | - | - | S |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=25V, $V_{GS}$=0V, f=1MHz | - | 1400 | - | pF |
| $C_{oss}$ | Output Capacitance | | - | 330 | - | |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 120 | - | |
| $t_{d(on)}$ | Turn-on Delay Time | ($V_{DD}$=200V, $I_D$=10A, $R_G$=9.1Ω, $R_D$=20Ω)*4 | - | 14 | - | ns |
| $t_r$ | Rise Time | | - | 27 | - | |
| $t_{d(off)}$ | Turn-off Delay Time | | - | 50 | - | |
| $t_f$ | Fall Time | | - | 24 | - | |
| $Q_g$ | Total Gate Charge | ($V_{DS}$=320V, $I_D$=10A, $V_{GS}$=10V)*4 | - | - | 63 | nC |
| $Q_{gs}$ | Gate-Source Charge | | - | - | 9 | |
| $Q_{gd}$ | Gate-Drain Charge | | - | - | 32 | |
| $L_D$ | Internal Drain Inductance (Measured from the drain lead 0.25” from package to center of die) | | - | 4.5 | - | nH |
| $L_S$ | Internal Source Inductance (Measured from the drain lead 0.25” from package to source bond pad) | | - | 7.5 | - | nH |

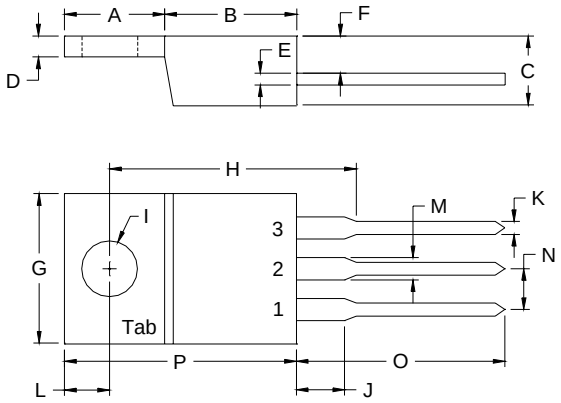
*4: Pulse Test: Pulse Width≤300us, Duty Cycle≤2%

## Source-Drain Diode

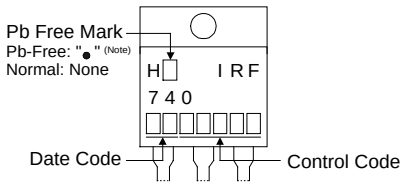
| Symbol | Characteristic | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | MOSFET symbol showing the integral reverse P-N junction diode   | - | - | 10 | A |
| $I_{SM}$ | Pulsed Source Current (Body Diode)*1 | | - | - | 40 | A |
| $t_{rr}$ | Reverse Recovery Time | $I_F$=10A, $d_i/d_t$=100A/us, $T_J$=25°C*4 | - | 370 | 790 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 3.8 | 8.2 | uC |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=10A, $V_{GS}$=0V, $T_J$=25°C (*4) | - | - | 2 | V |
| $t_{on}$ | Forward Turn-On Time | | - | ** | - | |

**: Negligible, Dominated by circuit inductance

## TO-220AB Dimension




Marking:




Note: Green label is used for pb-free packing

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

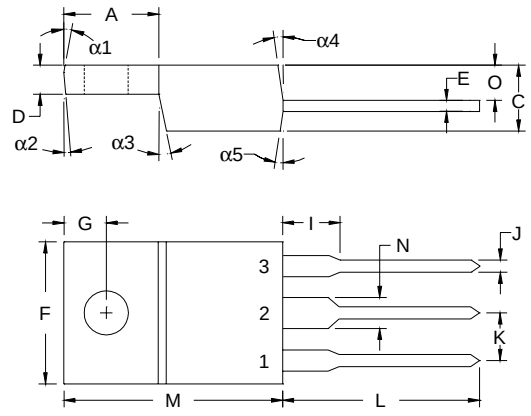
Material:
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

| DIM | Min. | Max. |
|---|---|---|
| A | 5.58 | 7.49 |
| B | 8.38 | 8.90 |
| C | 4.40 | 4.70 |
| D | 1.15 | 1.39 |
| E | 0.35 | 0.60 |
| F | 2.03 | 2.92 |
| G | 9.66 | 10.28 |
| H | - | *16.25 |
| I | - | *3.83 |
| J | 3.00 | 4.00 |
| K | 0.75 | 0.95 |
| L | 2.54 | 3.42 |
| M | 1.14 | 1.40 |
| N | - | *2.54 |
| O | 12.70 | 14.27 |
| P | 14.48 | 15.87 |

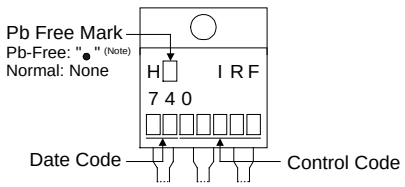
*: Typical, Unit: mm

3-Lead TO-220AB
Plastic Package
HSMC Package Code: E

## TO-220FP Dimension




Marking:




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 | 6.48 | 7.40 |
| C | 4.40 | 4.90 |
| D | 2.34 | 3.00 |
| E | 0.45 | 0.80 |
| F | 9.80 | 10.36 |
| G | 3.10 | 3.60 |
| I | 2.70 | 3.43 |
| J | 0.60 | 1.00 |
| K | 2.34 | 2.74 |
| L | 12.48 | 13.60 |
| M | 15.67 | 16.20 |
| N | 0.90 | 1.47 |
| O | 2.00 | 2.96 |
| α1/2/4/5 | - | *5° |
| α3 | - | *27° |

*: Typical, Unit: mm

3-Lead TO-220FP
Plastic Package
HSMC Package Code: F



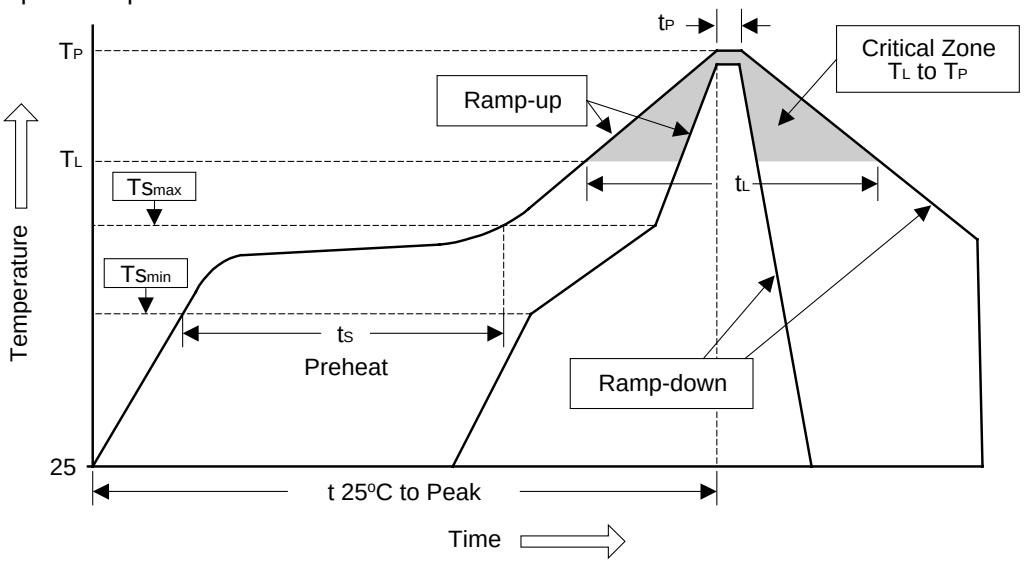
***Head Office And Factory:***
- **Head Office** (Hi-Sincerity Microelectronics Corp.): 10F.,No. 61, Sec. 2, Chung-Shan N. Rd. Taipei Taiwan R.O.C.
  Tel: 886-2-25212056 Fax: 886-2-25632712, 25368454
- **Factory 1:** No. 38, Kuang Fu S. Rd., Fu-Kou Hsin-Chu Industrial Park Hsin-Chu Taiwan. R.O.C
  Tel: 886-3-5983621~5 Fax: 886-3-5982931

## 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<br>- Temperature Min ($Ts_{min}$)<br>- Temperature Max ($Ts_{max}$)<br>- Time (min to max) (ts) | <br>100°C<br>150°C<br>60~120 sec | <br>150°C<br>200°C<br>60~180 sec |
| Tsmax to $T_L$<br>- Ramp-up Rate | <br><3°C/sec | <br><3°C/sec |
| Time maintained above:<br>- Temperature ($T_L$)<br>- Time ($t_L$) | <br>183°C<br>60~150 sec | <br>217°C<br>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 |