

4A, 500V

Half-Bridge Module

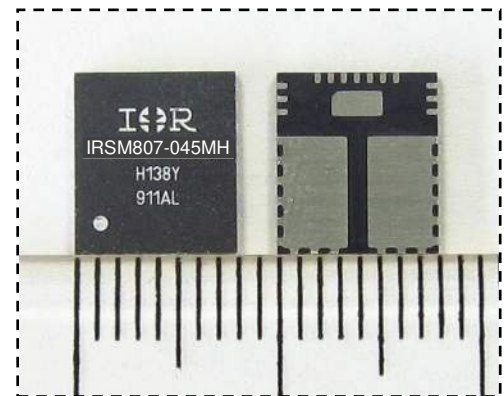
For Small Appliance Motor Drive Applications

Description

IRSM807-045MH is a 4A, 500V half-bridge module designed for advanced appliance motor drive applications such as energy efficient fans and pumps. IR's technology offers an extremely compact, high performance half-bridge topology in an isolated package. This advanced IPM offers a combination of IR's low $R_{DS(on)}$ Trench FREDFET technology and the industry benchmark half-bridge high voltage, rugged driver in a small PQFN package. At only 8x9mm and featuring integrated bootstrap functionality, the compact footprint of this surface-mount package makes it suitable for applications that are space-constrained. IRSM807-045MH functions without a heat sink.

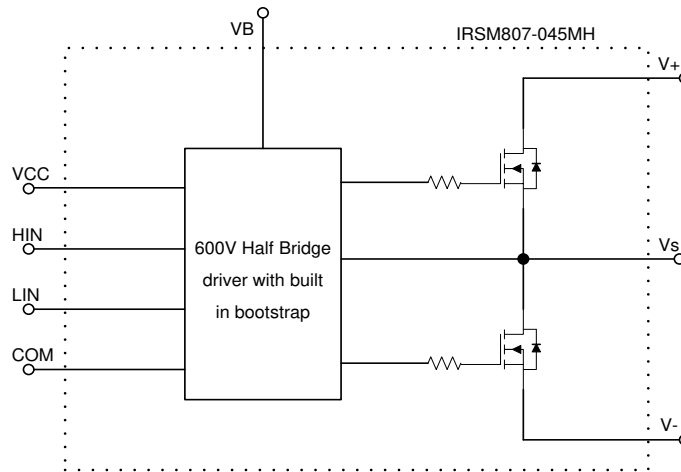
Features

- Integrated gate drivers and bootstrap functionality
- Suitable for sinusoidal or trapezoidal modulation
- Low $R_{DS(on)}$ Trench FREDFET
- Under-voltage lockout for both channels
- Matched propagation delay for all channels
- Optimized dV/dt for loss and EMI trade offs
- 3.3V input logic compatible
- Active high HIN and LIN
- Isolation 1500VRMS min



| Base Part Number | Package Type | Standard Pack | | Orderable Part Number |
|------------------|--------------|---------------|----------|-----------------------|
| | | Form | Quantity | |
| IRSM807-045MH | 32L PQFN 8x9 | Tray | 1300 | IRSM807-045MH |
| | | Tape & Reel | 2000 | IRSM807-045MHTR |

Internal Electrical Schematic



Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the module may occur. These are not tested at manufacturing. All voltage parameters are absolute voltages referenced to V_{SS} unless otherwise stated in the table. The thermal resistance rating is measured under board mounted and still air conditions.

| Symbol | Description | Min | Max | Unit |
|------------------------|--|-------------------|--------------------|------------|
| BV_{DSS} | FREDFET Blocking Voltage | --- | 500 | V |
| $I_O @ T_C=25^\circ C$ | DC Output Current | --- | 4 | A |
| I_{OP} | Pulsed Output Current (Note 1) | --- | 35 | |
| P_d | Maximum Power Dissipation per FREDFET @ $T_C = 25^\circ C$ | --- | 50 | W |
| V_{ISO} | Isolation Voltage (1min) (Note 2) | --- | 1500 | V_{RMS} |
| T_J | Operating Junction Temperature | -40 | 150 | $^\circ C$ |
| T_L | Lead Temperature (Soldering, 30 seconds) | --- | 260 | $^\circ C$ |
| T_S | Storage Temperature | -40 | 150 | $^\circ C$ |
| $V_{S1,2,3}$ | High Side Floating Supply Offset Voltage | $V_{B1,2,3} - 20$ | $V_{B1,2,3} + 0.3$ | V |
| $V_{B1,2,3}$ | High Side Floating Supply Voltage | -0.3 | 500 | V |
| V_{CC} | Low Side and Logic Supply voltage | -0.3 | 20 | V |
| V_{IN} | Input Voltage of LIN, HIN | $V_{SS} - 0.3$ | $V_{CC} + 0.3$ | V |

Note 1: Pulse Width = 100 μs , $T_C = 25^\circ C$, Duty=1%.

Note 2: Characterized, not tested at manufacturing.

Recommended Operating Conditions

| Symbol | Description | Min | Max | Unit |
|---------------------|--|--------------------|--------------------|------|
| V ⁺ | Positive DC Bus Input Voltage | --- | 400 | V |
| V _{S1,2,3} | High Side Floating Supply Offset Voltage | (Note 3) | 400 | V |
| V _{B1,2,3} | High Side Floating Supply Voltage | V _S +12 | V _S +20 | V |
| V _{CC} | Low Side and Logic Supply Voltage | 12 | 16.5 | V |
| V _{IN} | Logic Input Voltage | COM | V _{CC} | V |
| F _p | PWM Carrier Frequency | --- | 20 | kHz |

The Input/Output logic diagram is shown in Figure 1. For proper operation the module should be used within the recommended conditions. All voltages are absolute referenced to COM. The V_S offset is tested with all supplies biased at 15V differential.

Note 3: Logic operational for V_S from COM-8V to COM+500V. Logic state held for V_S from COM-8V to COM-V_{BS}.

Static Electrical Characteristics

(V_{CC}-COM) = (V_B-V_S) = 15 V. T_A = 25°C unless otherwise specified. The V_{IN} and I_{IN} parameters are referenced to V_{SS} and are applicable to all six channels. The V_{CCUV} parameters are referenced to V_{SS}. The V_{BSUV} parameters are referenced to V_S.

| Symbol | Description | Min | Typ | Max | Units | Conditions |
|--|--|-----|------|------|-------|---|
| BV _{DSS} | Drain-to-Source Breakdown Voltage | 500 | --- | --- | V | T _J =25°C, I _{LK} =250μA |
| I _{LKH} | Leakage Current of High Side FET | | 10 | | μA | T _J =25°C, V _{DS} =500V |
| I _{LKL} | Leakage Current of Low Side FET Plus Gate Drive IC | | 15 | | μA | T _J =25°C, V _{DS} =500V |
| R _{DS(ON)} | Drain to Source ON Resistance | --- | 1.5 | 1.7 | Ω | T _J =25°C, V _{CC} =10V, I _d = 2A |
| | | --- | 3 | --- | | T _J =150°C, V _{CC} =10V, I _d = 2A (Note 4) |
| V _{SD} | Diode Forward Voltage | --- | 0.85 | --- | V | T _J =25°C, I _d = 2A |
| V _{HIN/LIN} | Logic "1" input voltage for HIN and LIN | 2.2 | --- | --- | V | |
| V _{HIN/LIN} | Logic "0" input voltage for HIN and LIN | --- | --- | 0.8 | V | |
| V _{CCUV+} , V _{BSUV+} | V _{CC} and V _{BS} Supply Under-Voltage, Positive Going Threshold | 8 | 8.9 | 9.8 | V | |
| V _{CCUV-} , V _{BSUV-} | V _{CC} and V _{BS} supply Under-Voltage, Negative Going Threshold | 6.9 | 7.7 | 8.5 | V | |
| V _{CCUVH} , V _{BSUVH} | V _{CC} and V _{BS} Supply Under-Voltage Lock-Out Hysteresis | --- | 0.7 | --- | V | |
| I _{QBS} | Quiescent V _{BS} Supply Current V _{IN} =0V | --- | 45 | 70 | μA | |
| I _{QCC} | Quiescent V _{CC} Supply Current V _{IN} =0V | --- | 1100 | 3000 | μA | |
| I _{IN+} | Input Bias Current V _{IN} =4V | --- | 5 | 20 | μA | |
| I _{IN-} | Input Bias Current V _{IN} =0V | --- | --- | 2 | μA | |
| R _{BR} | Internal Bootstrap Equivalent Resistor Value | --- | 200 | --- | Ω | T _J =25°C |

Note 4: Characterized, not tested at manufacturing

Dynamic Electrical Characteristics

(V_{CC-COM}) = (V_B-V_S) = 15 V. $T_A = 25^\circ\text{C}$ unless otherwise specified.

| Symbol | Description | Min | Typ | Max | Units | Conditions |
|--------------|---|-----|-----|-----|---------------|-------------------------------------|
| T_{ON} | Input to Output Propagation Turn-On Delay Time | --- | 0.9 | 1.5 | μs | $I_D=1\text{mA}$, $V^+=50\text{V}$ |
| T_{OFF} | Input to Output Propagation Turn-Off Delay Time | --- | 0.9 | 1.5 | μs | |
| DT | Built-in Dead Time | --- | 300 | --- | ns | |
| $T_{FIL,IN}$ | Input Filter Time (HIN, LIN) | --- | 300 | --- | ns | |

FREDFET Avalanche Characteristics

| Symbol | Description | Min | Typ | Max | Units | Conditions |
|--------|--|-----|-----|-----|-------|---|
| EAS | Single Pulse Avalanche Energy (Note 5) | --- | 209 | --- | mJ | $T_J=25^\circ\text{C}$, $L=9.5\text{mH}$, $V_{DD}=150\text{V}$, $I_{AS}=6.7\text{A}$ |

Note 5: Characterized using TO-220 packaged device

Thermal and Mechanical Characteristics

| Symbol | Description | Min | Typ | Max | Units | Conditions |
|----------------|---|-----|------|-----|--------------------|------------|
| $R_{th(J-CT)}$ | Total Thermal Resistance Junction to Case Top (Note 6) | --- | 25 | --- | $^\circ\text{C/W}$ | |
| $R_{th(J-CB)}$ | Total Thermal Resistance Junction to Case Bottom (Note 6) | --- | 1.55 | --- | $^\circ\text{C/W}$ | |

Note 6: Calculated

Qualification Information†

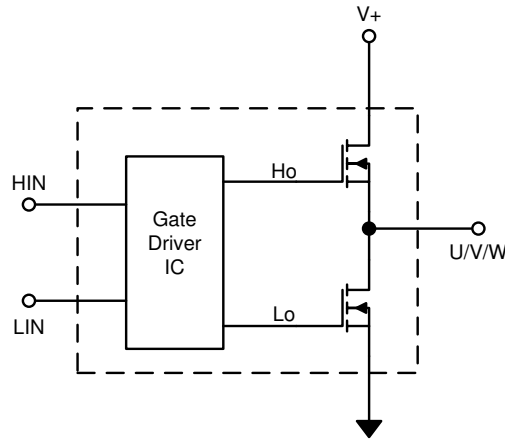
| | | |
|-----------------------------------|-------------------------|--------------------------|
| Qualification Level | | Industrial ^{††} |
| Moisture Sensitivity Level | | MSL3 ^{†††} |
| ESD | Machine Model | Class B |
| | Human Body Model | Class 1C |
| RoHS Compliant | | Yes |

† Qualification standards can be found at International Rectifier's web site <http://www.irf.com/>

†† Higher qualification ratings may be available should the user have such requirements. Please contact your International Rectifier sales representative for further information.

††† Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information.

Input-Output Logic Level Table



| HIN | LIN | U,V,W |
|-----|-----|-------|
| HI | LO | V+ |
| LO | HI | 0 |
| HI | HI | ** |
| LO | LO | * |

* V+ if motor current is flowing into VS, 0 if current is flowing out of VS into the motor winding
 ** Anti Shoot-through protection active (LO, HO are switched off)

Referenced Figures

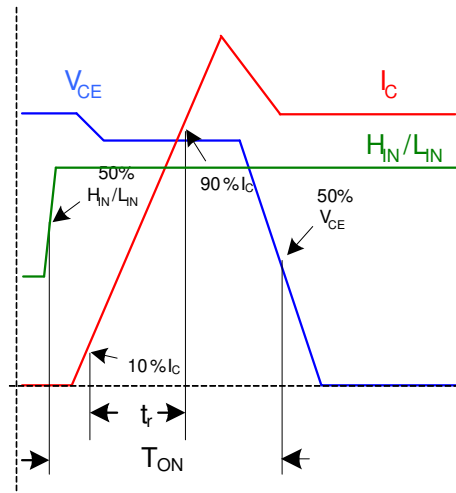


Figure 1a. Input to Output propagation turn-on delay time.

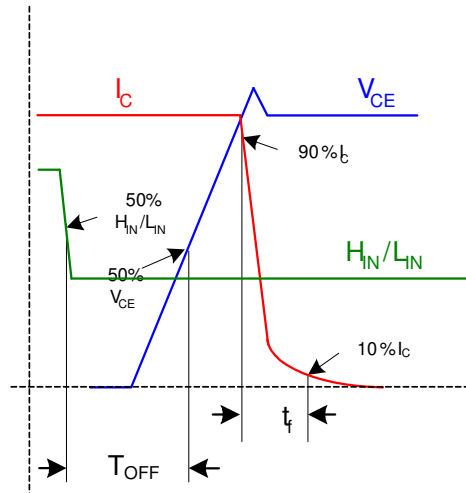


Figure 1b. Input to Output propagation turn-off delay time.

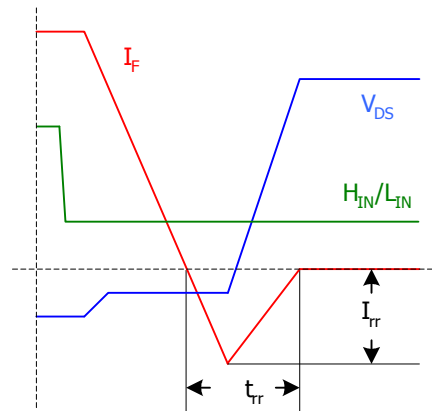
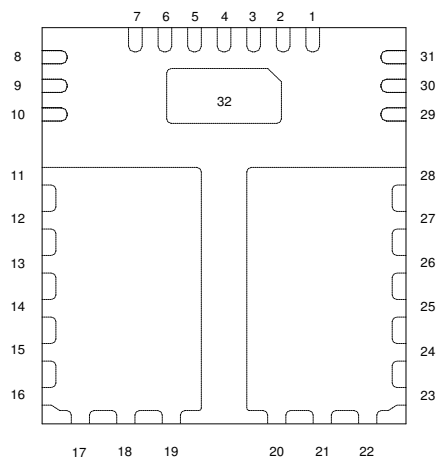


Figure 1c. Diode Reverse Recovery.

Figure 1. Switching Parameter Definitions

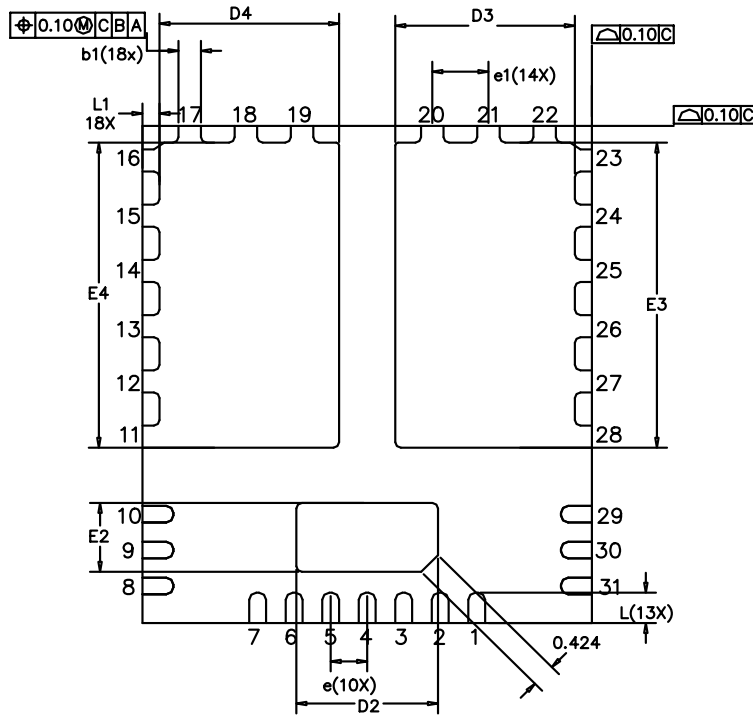
Module Pin-Out Description

| Pin | Name | Description |
|-------------|------|--|
| 1, 4, 7, 32 | COM | Low Side Gate Drive Return |
| 2 | VCC | 15V Gate Drive Supply |
| 3 | HIN | Logic Input for High Side (Active High) |
| 5 | LIN | Logic Input for Low Side (Active High) |
| 6 | NC | Not Connected |
| 8, 9, 10 | V- | Low Side Source Connection |
| 11 – 19 | VS | Phase Output |
| 20 – 28 | V+ | DC Bus |
| 29 – 30 | VS | Phase Output (-ve Bootstrap Cap Connection) |
| 31 | VB | High Side Floating Supply (+ve Bootstrap Cap Connection) |
| 32 | - | To be connected to COM |



Top view

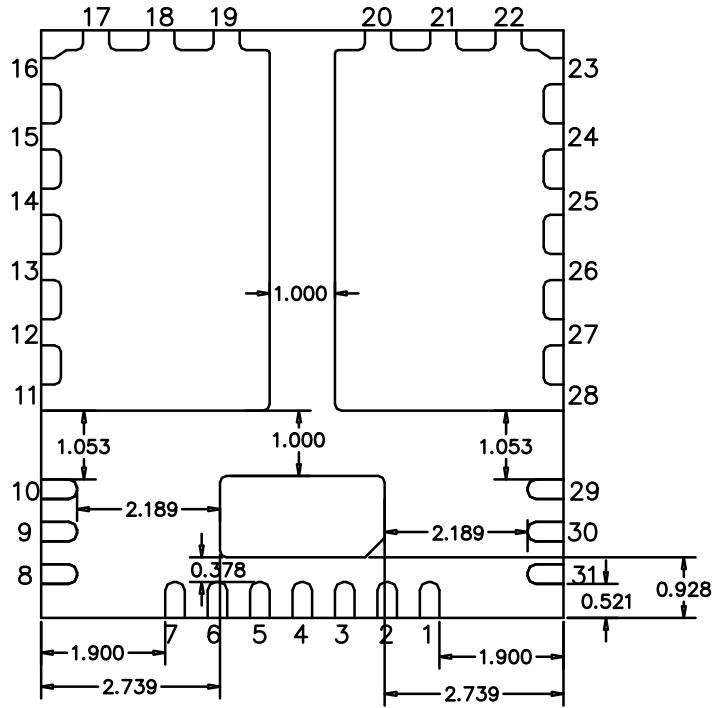
Package Outline IRSM807-045MH (Bottom View), 1 of 2



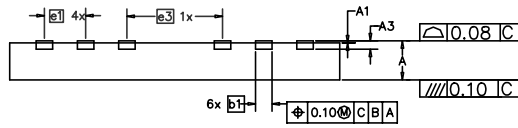
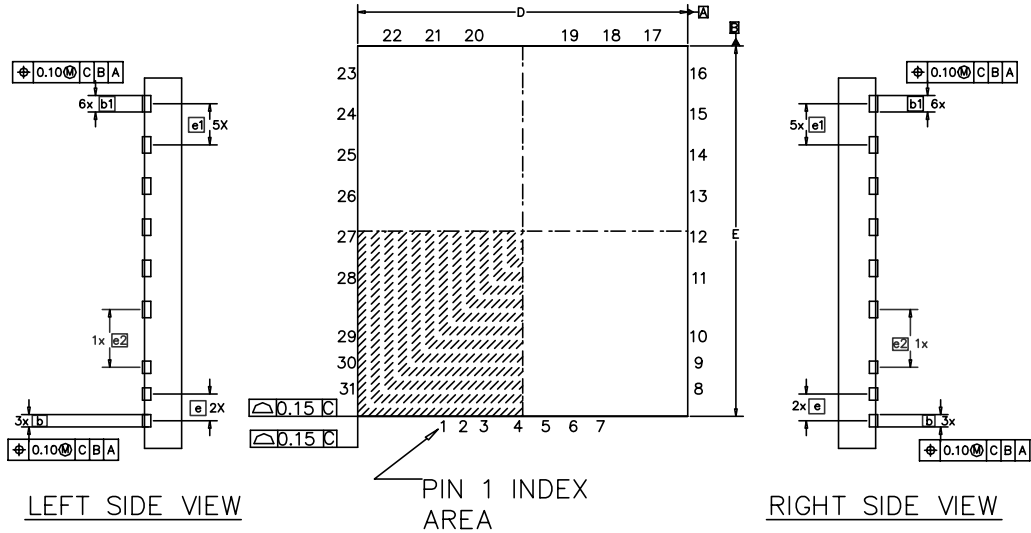
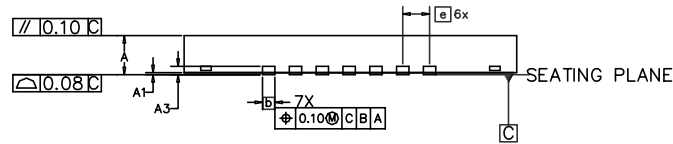
| SYMBOL | DIMENSIONS IN MILLIMETER | | |
|--------|--------------------------|-------|-------|
| | MIN. | NOM. | MAX. |
| A | 0.800 | 0.900 | 1.000 |
| A1 | 0.000 | | 0.050 |
| A3 | 0.203 REF. | | |
| b | 0.250 | 0.300 | 0.350 |
| b1 | 0.350 | 0.400 | 0.450 |
| D | 7.900 | 8.000 | 8.100 |
| E | 8.900 | 9.000 | 9.100 |
| D2 | 2.472 | 2.522 | 2.572 |
| E2 | 1.197 | 1.247 | 1.297 |
| D3 | 3.147 | 3.197 | 3.247 |
| E3 | 5.472 | 5.522 | 5.572 |
| D4 | 3.147 | 3.197 | 3.247 |
| E4 | 5.472 | 5.522 | 5.572 |
| e | 0.650 BSC | | |
| e1 | 1.000 BSC | | |
| e2 | 1.403 BSC | | |
| e3 | 2.318 BSC | | |
| L | 0.500 | 0.550 | 0.600 |
| L1 | 0.253 | 0.303 | 0.353 |

Dimensions in mm

Package Outline IRSM807-045MH (Bottom View), 2 of 2



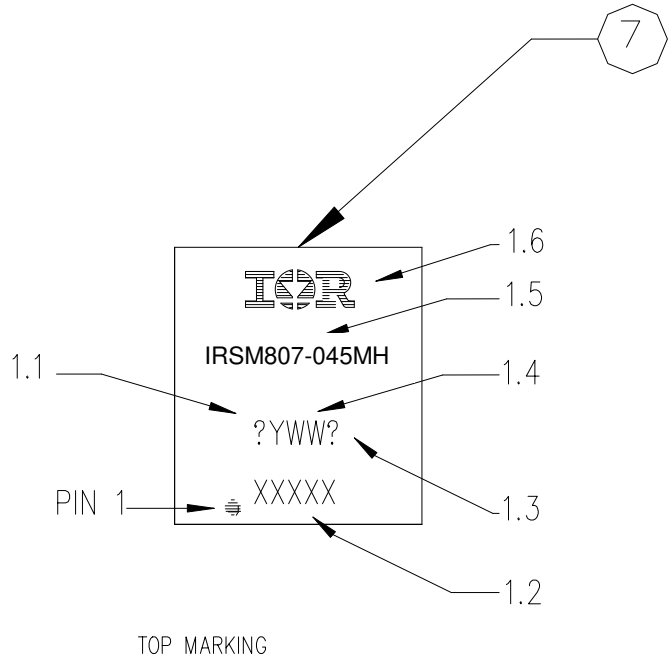
Dimensions in mm

Package Outline IRSM807-045MH (Top & Side View)
BACK SIDE VIEW

TOP VIEW

LEFT SIDE VIEW
RIGHT SIDE VIEW

FRONT SIDE VIEW

| SYMBOL | DIMENSIONS IN MILLIMETER | | | | | | |
|--------|--------------------------------|-------|-------|----|-----------|-------|-------|
| | MIN. | NOM. | MAX. | | | | |
| A | 0.800 | 0.900 | 1.000 | E2 | 1.197 | 1.247 | 1.297 |
| A1 | 0.000 | | 0.050 | D3 | 3.147 | 3.197 | 3.247 |
| A3 | 0.203 REF. | | | E3 | 5.472 | 5.522 | 5.572 |
| b | 0.250 | 0.300 | 0.350 | D4 | 3.147 | 3.197 | 3.247 |
| b1 | 0.350 | 0.400 | 0.450 | E4 | 5.472 | 5.522 | 5.572 |
| D | 7.900 | 8.000 | 8.100 | e | 0.650 BSC | | |
| E | 8.900 | 9.000 | 9.100 | e1 | 1.000 BSC | | |
| D2 | 2.472 | 2.522 | 2.572 | e2 | 1.403 BSC | | |
| | | | | e3 | 2.318 BSC | | |
| | | | | L | 0.500 | 0.550 | 0.600 |
| | | | | L1 | 0.253 | 0.303 | 0.353 |

Dimensions in mm

Top Marking



- NOTES, MARKING:
- 1.1) SITE CODE: X
 - 1.2) LAST 4 CHARACTER OF SPN/NANA CODE: XXXX
 - 1.3) LEADFREE INDICATOR: P
 - 1.4) DATE CODE: YWW
 - 1.5) PART NUMBER: IRSM607-105MH
 - 1.6) IR LOGO
 - 1.7) MEDIUM:
 - 1.7.1) TOP: LASER
 - 1.7.2) BOTTOM: NONE

Revision History

International
 Rectifier

Data and Specifications are subject to change without notice
IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903

Visit us at www.irf.com for sales contact information

[Submit Datasheet Feedback](#)