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## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



# **4A, 500V**

## **Half-Bridge Module**

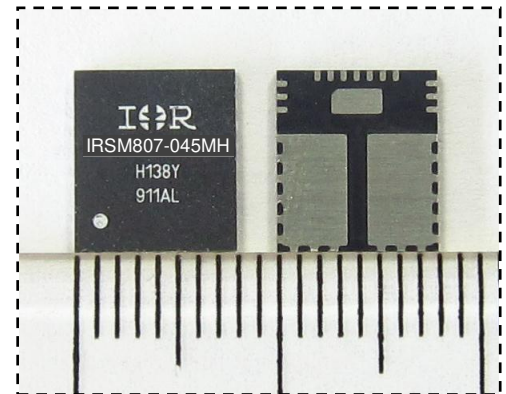
### **For Small Appliance Motor Drive Applications**

#### **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.

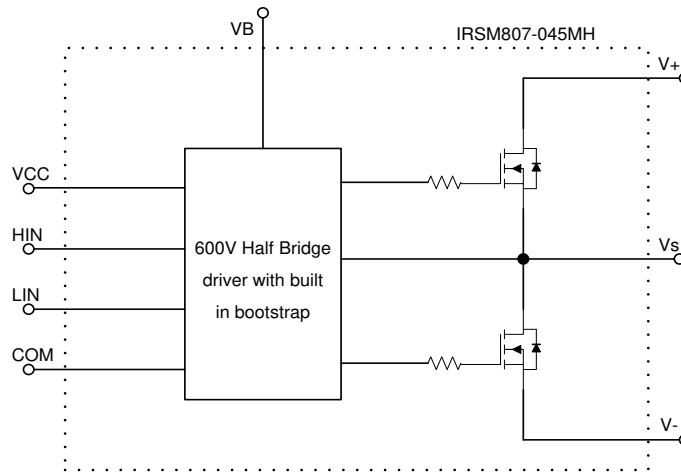
#### **Features**

- 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 $\mu s$ ,  $T_C = 25^\circ C$ , Duty=1%.

Note 2: Characterized, not tested at manufacturing.

### Recommended Operating Conditions

Symbol	Description	Min	Max	Unit
V <sup>+</sup>	Positive DC Bus Input Voltage	---	400	V
V <sub>S1,2,3</sub>	High Side Floating Supply Offset Voltage	(Note 3)	400	V
V <sub>B1,2,3</sub>	High Side Floating Supply Voltage	V <sub>S</sub> +12	V <sub>S</sub> +20	V
V <sub>CC</sub>	Low Side and Logic Supply Voltage	12	16.5	V
V <sub>IN</sub>	Logic Input Voltage	COM	V <sub>CC</sub>	V
F <sub>p</sub>	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<sub>S</sub> offset is tested with all supplies biased at 15V differential.

Note 3: Logic operational for V<sub>S</sub> from COM-8V to COM+500V. Logic state held for V<sub>S</sub> from COM-8V to COM-V<sub>BS</sub>.

### Static Electrical Characteristics

(V<sub>CC</sub>-COM) = (V<sub>B</sub>-V<sub>S</sub>) = 15 V. T<sub>A</sub> = 25°C unless otherwise specified. The V<sub>IN</sub> and I<sub>IN</sub> parameters are referenced to V<sub>SS</sub> and are applicable to all six channels. The V<sub>CCUV</sub> parameters are referenced to V<sub>SS</sub>. The V<sub>BSUV</sub> parameters are referenced to V<sub>S</sub>.

Symbol	Description	Min	Typ	Max	Units	Conditions
BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	500	---	---	V	T <sub>J</sub> =25°C, I <sub>LK</sub> =250μA
I <sub>LKH</sub>	Leakage Current of High Side FET		10		μA	T <sub>J</sub> =25°C, V <sub>DS</sub> =500V
I <sub>LKL</sub>	Leakage Current of Low Side FET Plus Gate Drive IC		15		μA	T <sub>J</sub> =25°C, V <sub>DS</sub> =500V
R <sub>DS(ON)</sub>	Drain to Source ON Resistance	---	1.5	1.7	Ω	T <sub>J</sub> =25°C, V <sub>CC</sub> =10V, I <sub>d</sub> = 2A
		---	3	---		T <sub>J</sub> =150°C, V <sub>CC</sub> =10V, I <sub>d</sub> = 2A (Note 4)
V <sub>SD</sub>	Diode Forward Voltage	---	0.85	---	V	T <sub>J</sub> =25°C, I <sub>d</sub> = 2A
V <sub>HIN/LIN</sub>	Logic "1" input voltage for HIN and LIN	2.2	---	---	V	
V <sub>HIN/LIN</sub>	Logic "0" input voltage for HIN and LIN	---	---	0.8	V	
V <sub>CCUV+</sub> , V <sub>BSUV+</sub>	V <sub>CC</sub> and V <sub>BS</sub> Supply Under-Voltage, Positive Going Threshold	8	8.9	9.8	V	
V <sub>CCUV-</sub> , V <sub>BSUV-</sub>	V <sub>CC</sub> and V <sub>BS</sub> supply Under-Voltage, Negative Going Threshold	6.9	7.7	8.5	V	
V <sub>CCUVH</sub> , V <sub>BSUVH</sub>	V <sub>CC</sub> and V <sub>BS</sub> Supply Under-Voltage Lock-Out Hysteresis	---	0.7	---	V	
I <sub>QBS</sub>	Quiescent V <sub>BS</sub> Supply Current V <sub>IN</sub> =0V	---	45	70	μA	
I <sub>QCC</sub>	Quiescent V <sub>CC</sub> Supply Current V <sub>IN</sub> =0V	---	1100	3000	μA	
I <sub>IN+</sub>	Input Bias Current V <sub>IN</sub> =4V	---	5	20	μA	
I <sub>IN-</sub>	Input Bias Current V <sub>IN</sub> =0V	---	---	2	μA	
R <sub>BR</sub>	Internal Bootstrap Equivalent Resistor Value	---	200	---	Ω	T <sub>J</sub> =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	$\mu\text{s}$	$I_D=1\text{mA}$ , $V^+=50\text{V}$
$T_{OFF}$	Input to Output Propagation Turn-Off Delay Time	---	0.9	1.5	$\mu\text{s}$	
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†

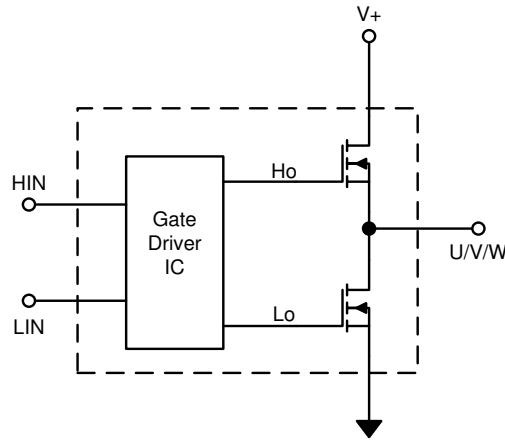
<b>Qualification Level</b>		Industrial <sup>††</sup>
<b>Moisture Sensitivity Level</b>		MSL3 <sup>†††</sup>
<b>ESD</b>	<b>Machine Model</b>	Class B
	<b>Human Body Model</b>	Class 1C
<b>RoHS Compliant</b>		Yes

† 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**

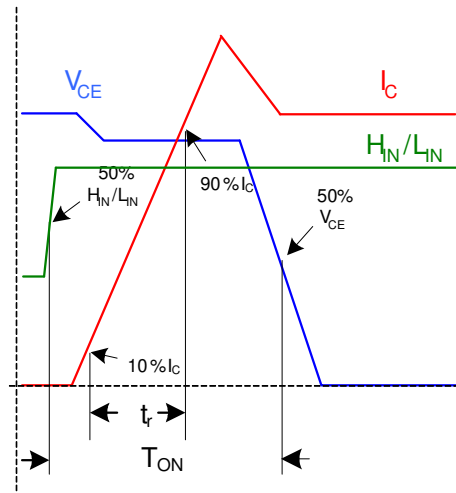


Figure 1a. Input to Output propagation turn-on delay time.

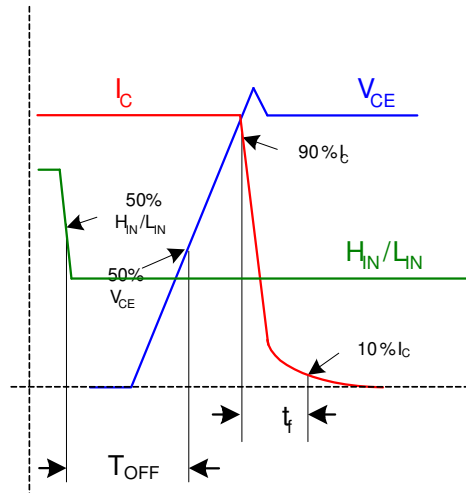


Figure 1b. Input to Output propagation turn-off delay time.

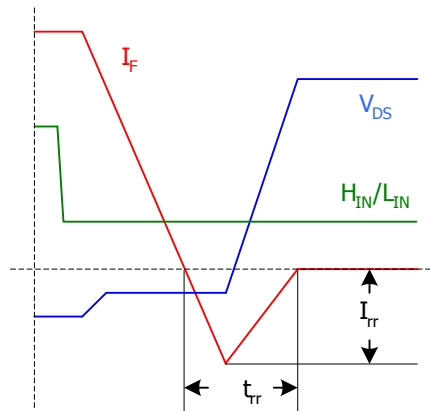
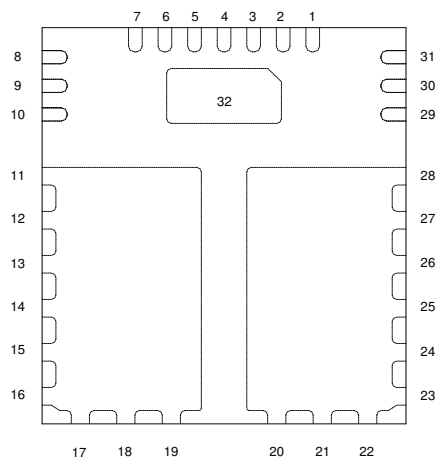


Figure 1c. Diode Reverse Recovery.

Figure 1. Switching Parameter Definitions

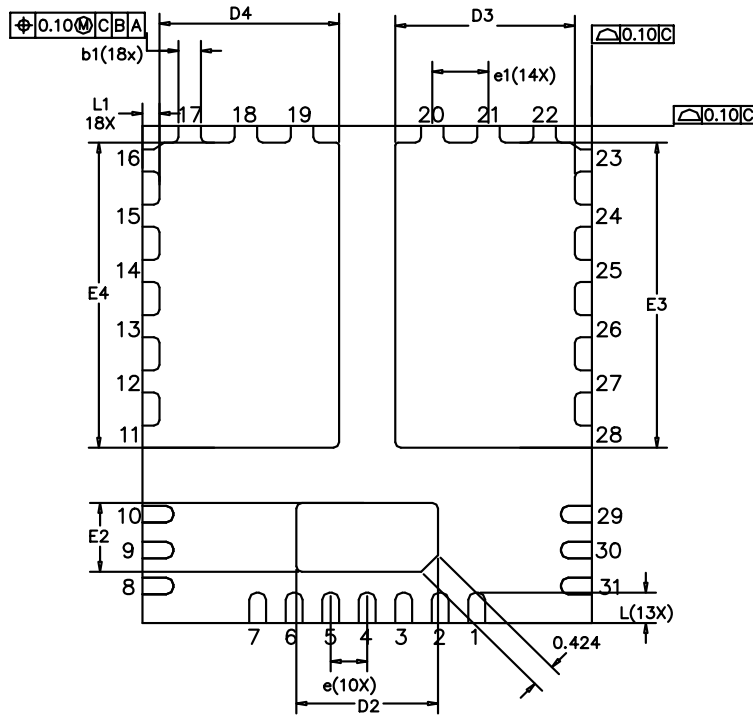
## Module Pin-Out Description

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

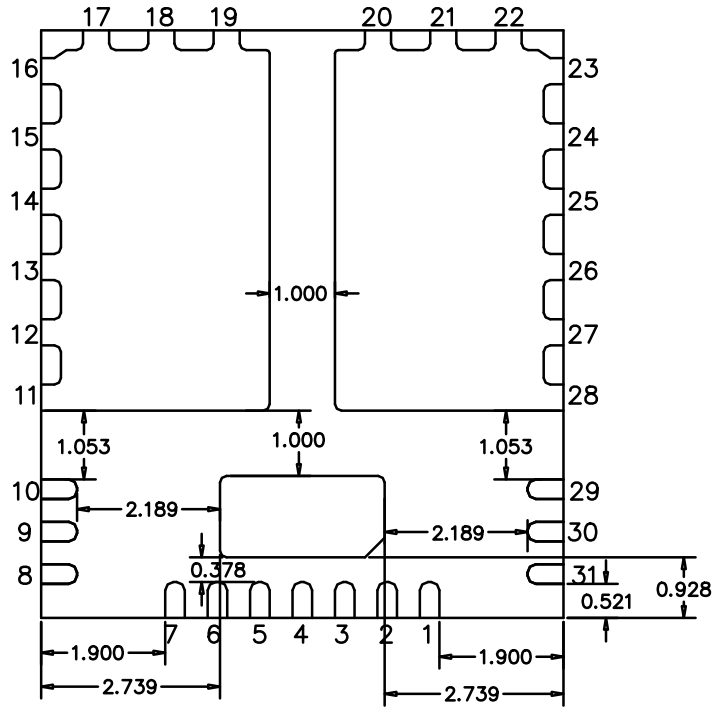


SYMBOL	DIMENSIONS IN MILLIMETER		
	MIN.	NOM.	MAX.
A	0.800	0.900	1.000
A1	0.000		0.050
A3	0.203 REF.		
b	0.250	0.300	0.350
b1	0.350	0.400	0.450
D	7.900	8.000	8.100
E	8.900	9.000	9.100
D2	2.472	2.522	2.572
E2	1.197	1.247	1.297
D3	3.147	3.197	3.247
E3	5.472	5.522	5.572
D4	3.147	3.197	3.247
E4	5.472	5.522	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

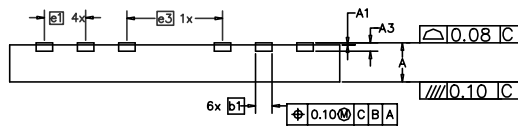
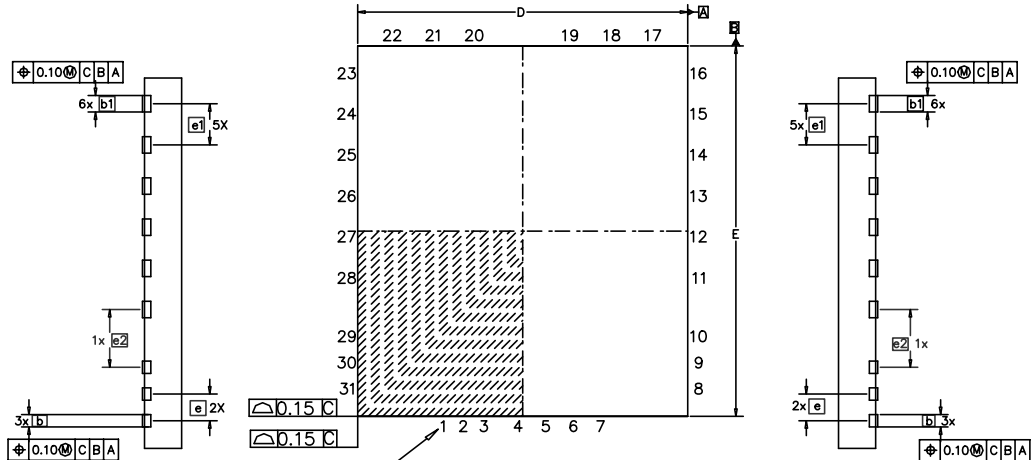
Dimensions in mm



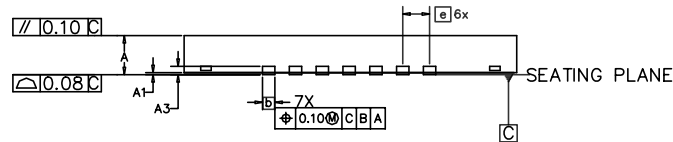
**Package Outline IRSM807-045MH (Bottom View), 2 of 2**



Dimensions in mm

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

TOP VIEW

LEFT SIDE VIEW
RIGHT SIDE VIEW

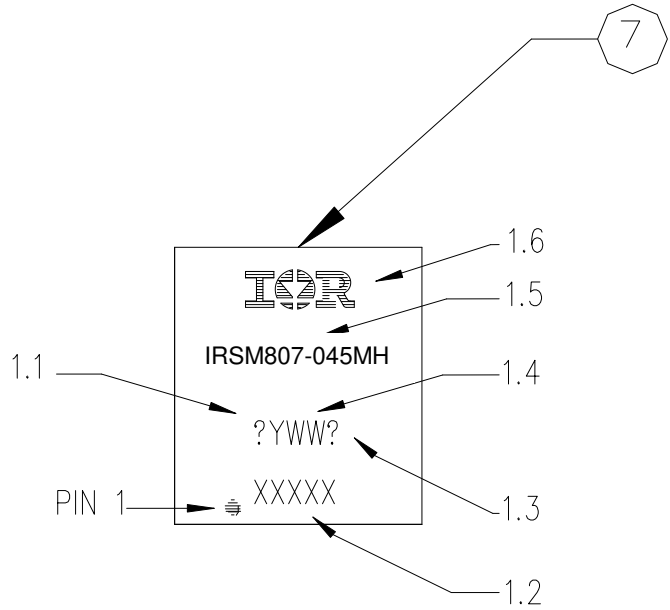
PIN 1 INDEX AREA


FRONT SIDE VIEW

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

**Top Marking**



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  
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