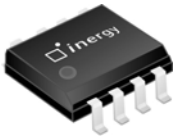
# iM4013



# N-Channel Enhancement Mode MOSFET

## 1. Product Information

### 1.1 Features

- ☑ Surface-mounted package
- ☑ Advanced trench cell design

### 1.2 Applications

- ☑ Motor appliances
- ☑ High power inverter system

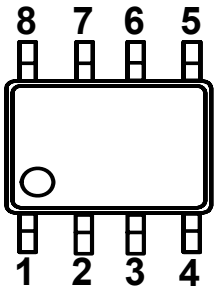
### 1.3 Quick reference

- ☑ BV ≧ 30 V
- ☑ $P_{tot}$ ≦ 2 W
- ☑ $I_D$ ≦ 13 A
- ☑ $R_{DS(ON)}$ ≦ 7 mΩ @ $V_{GS}$ = 10 V
  $R_{DS(ON)}$ ≦ 10.5 mΩ @ $V_{GS}$ = 4.5 V

## 2. Pin Description

| Pin | Description |
|---|---|
| 1,2,3 | Source(S) |
| 4 | Gate(G) |
| 5,6,7,8 | Drain(D) |

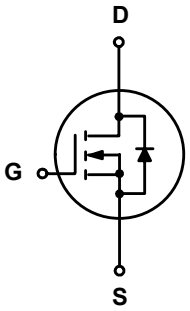
Simplified Outline

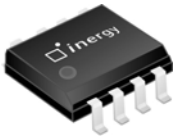



Top View

SOP- 8L

Symbol





## 3. Limiting Values

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | $T_A$ = 25 ℃ | - | 30 | V |
| $V_{GS}$ | Gate-Source Voltage | $T_A$ = 25 ℃ | - | ± 20 | V |
| $I_D$* | Drain Current | $T_A$ = 25 ℃, $V_{GS}$ = 10 V | - | 13 | A |
| | | $T_A$ = 100 ℃, $V_{GS}$ = 10 V | - | 8.7 | A |
| $I_{DM}$*,** | Pulsed Drain Current | $T_A$ = 25 ℃, $V_{GS}$ = 10 V | - | 52 | A |
| $P_{tot}$ | Total Power Dissipation | $T_A$ = 25 ℃ | - | 2 | W |
| $T_{stg}$ | Storage Temperature | | - 55 | 150 | ℃ |
| $T_J$ | Junction Temperature | | - 55 | 150 | ℃ |
| $I_S$ | Diode Forward Current | $T_A$ = 25 ℃ | - | 13 | A |
| $R_{\theta JA}$* | Thermal Resistance- Junction to Ambient | | - | 62.5 | ℃ / W |

Notes :

* Surface Mounted on 1 $in^2$ pad area, t ≤ 10 sec

** Pulse width ≤ 300 μs, duty cycle ≤ 2 %

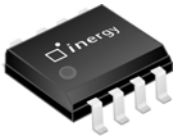
## 4. Marking Information

| Product Name | Marking |
|---|---|
| iM4013 | iM4013<br>XXXXX<br>X : Date Code |

## 5. Ordering Code

| | |
|---|---|
| iM4013 □<br>└── Assembly Material | Assembly Material<br>G: Halogen and Lead Free Device |

Note: inergy defines “Green” as lead-free ( RoHS compliant ) and halogen free ( Br or Cl does not exceed 900 ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500 ppm by weight; Follow IEC 61249-2-21 and IPC / JEDEC J-STD-020C )



## 6. Electrical Characteristics ( $T_A$=25 °C Unless Otherwise Noted )

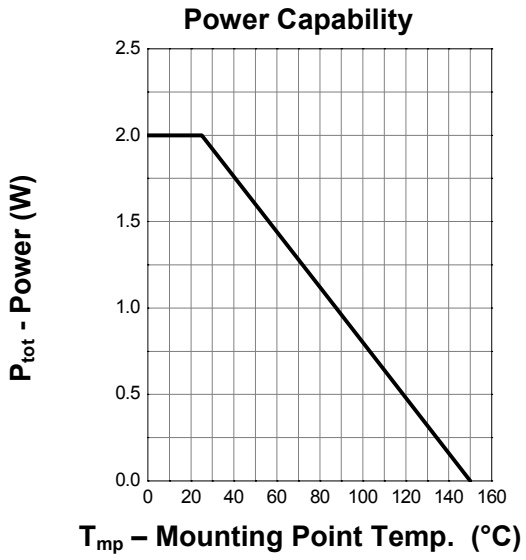
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Static Characteristics | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_{DS}$ = 250 µA | 30 | - | - | V |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_{DS}$ = 250 µA | 1.0 | - | 2.0 | V |
| $I_{DSS}$ | Drain Leakage Current | $V_{DS}$ = 24V, $V_{GS}$ = 0 V | - | - | 1 | µA |
| | | $T_J$ = 85 ℃ | - | - | 30 | µA |
| $I_{GSS}$ | Gate Leakage Current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | - | - | ± 100 | nA |
| $R_{DS(ON)}$[a] | On-State Resistance | $V_{GS}$ = 10 V, $I_{DS}$ = 13 A | - | 5.6 | 7 | mΩ |
| | | $V_{GS}$ = 4.5V, $I_{DS}$ = 10 A | - | 8 | 10.5 | |
| Diode Characteristics | | | | | | |
| $V_{SD}$[a] | Diode Forward Voltage | $I_{SD}$ = 13 A, $V_{GS}$ = 0V | - | - | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_{DS}$ = 13 A, $V_{GS}$ = 0 V<br>$dI_{SD}/dt$ = 100 A/µs | - | 11 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 4.4 | - | µC |
| Dynamic Characteristics[b] | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0 V, $V_{DS}$ = 15 V<br>Frequency = 1 MHz | - | 2414 | - | pF |
| $C_{oss}$ | Output Capacitance | | - | 215 | - | |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 182 | - | |
| $t_d$(on) | Turn-on Delay Time | $V_{DS}$ = 15 V, $V_{GEN}$ = 10 V,<br>$R_G$ = 6 Ω, $R_L$ = 1.15 Ω,<br>$I_{DS}$ = 13 A | - | 8.6 | - | ns |
| $t_r$ | Turn-on Rise Time | | - | 55 | - | |
| $t_d$(off) | Turn-off Delay Time | | - | 34 | - | |
| $t_f$ | Turn-off Fall Time | | - | 15 | - | |
| Gate Charge Characteristics[b] | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 10 V, $V_{DS}$ = 15 V,<br>$I_{DS}$ = 13 A | - | 44 | - | nC |
| $Q_{gs}$ | Gate-Source Charge | | - | 8.8 | - | |
| $Q_{gd}$ | Gate-Drain Charge | | - | 6 | - | |

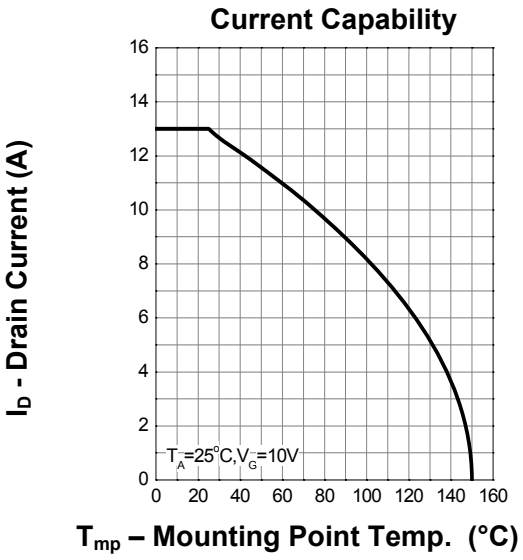
Notes：

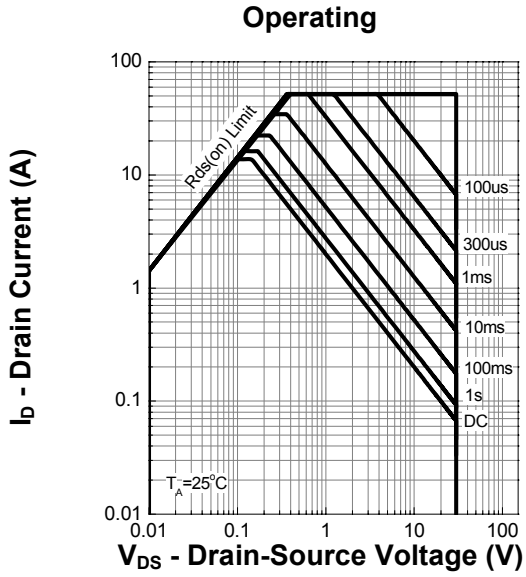
a : Pulse test ; pulse width ≤ 300 µs, duty cycle ≤ 2%

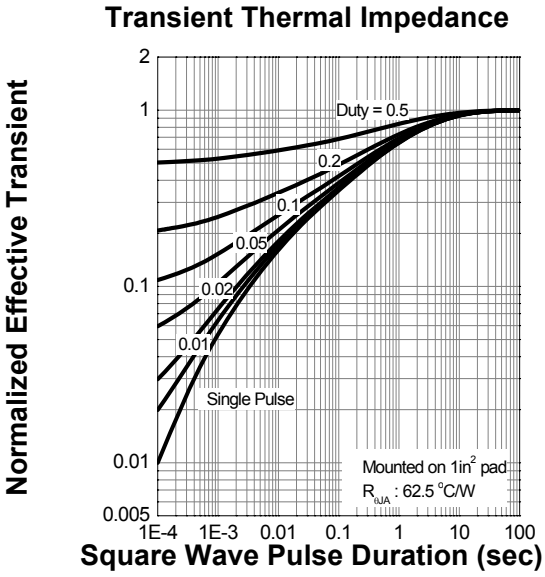
b : Guaranteed by design, not subject to production testing

## 7. Typical Characteristics



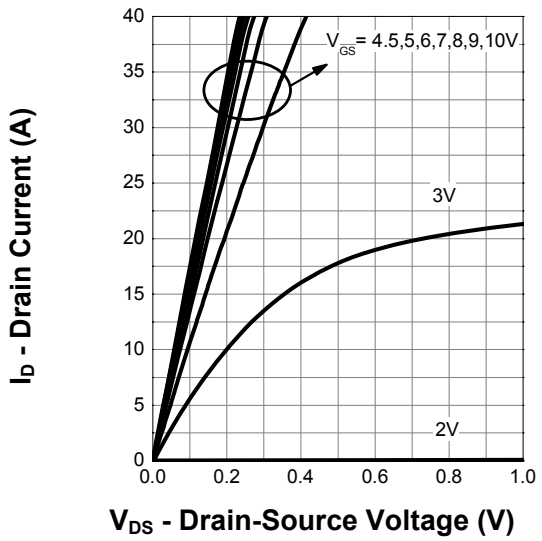



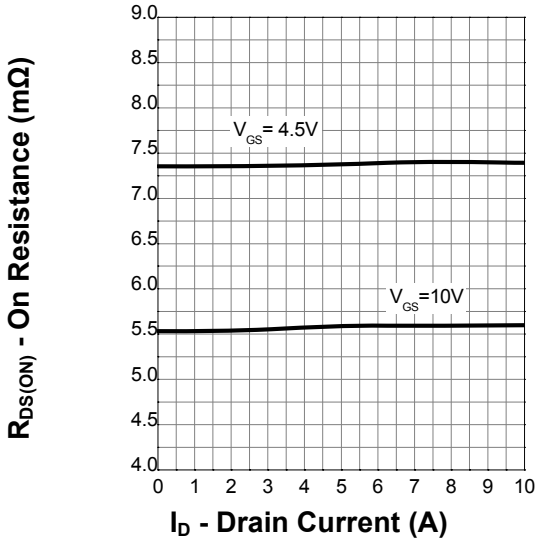



## 7. Typical Characteristics (cont.)

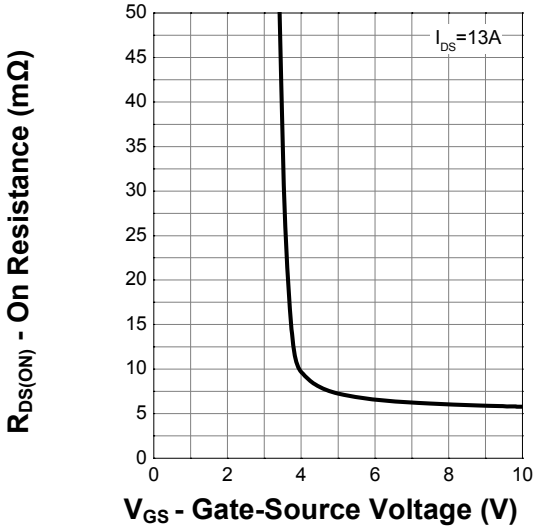
**Output Characteristics**



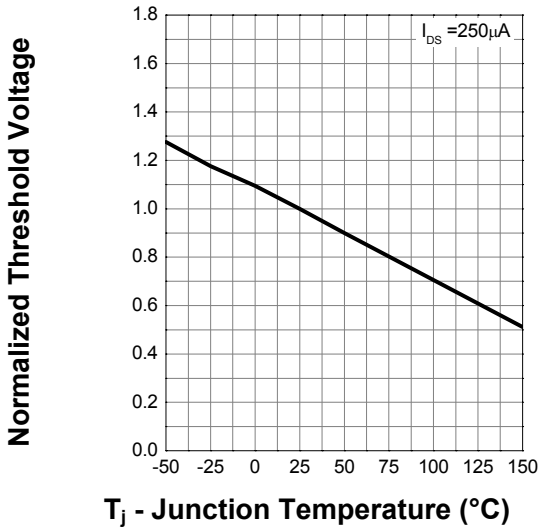

**On Resistance**




**Transfer Characteristics**

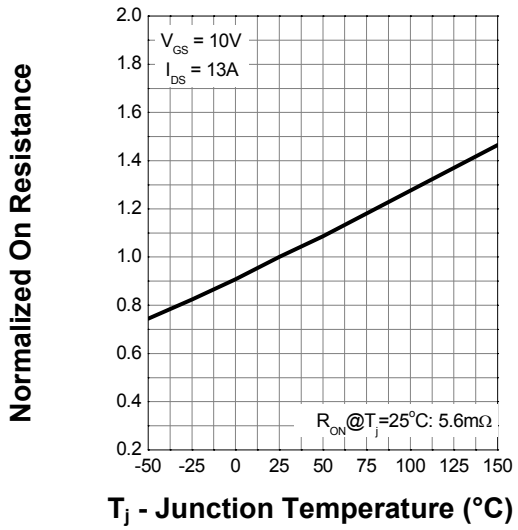



**Normalized Threshold Voltage**

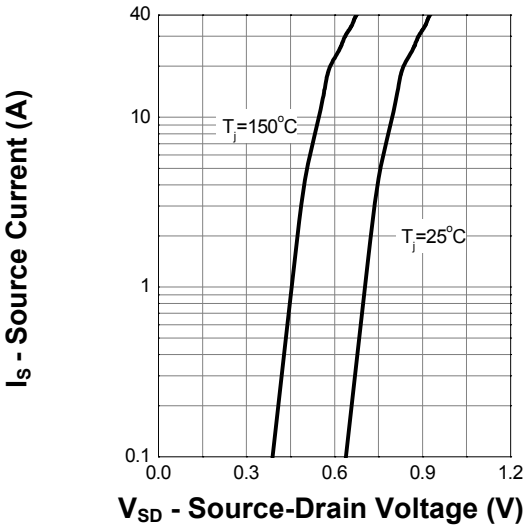


## 7. Typical Characteristics (cont.)

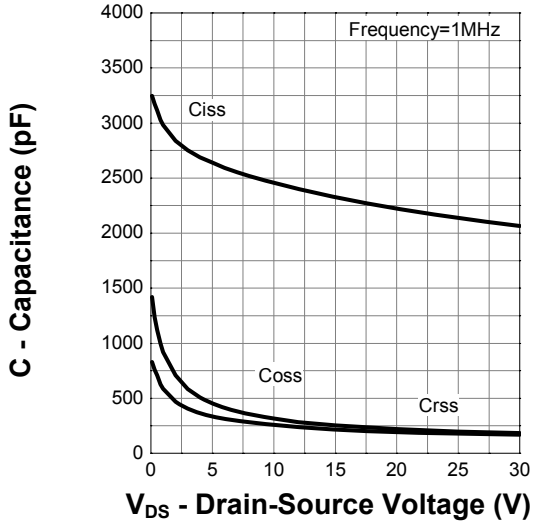
**Normalized On Resistance**



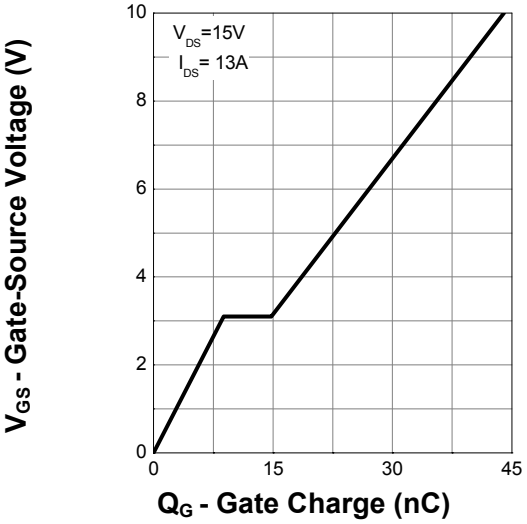

**Diode Forward Current**




**Capacitance**

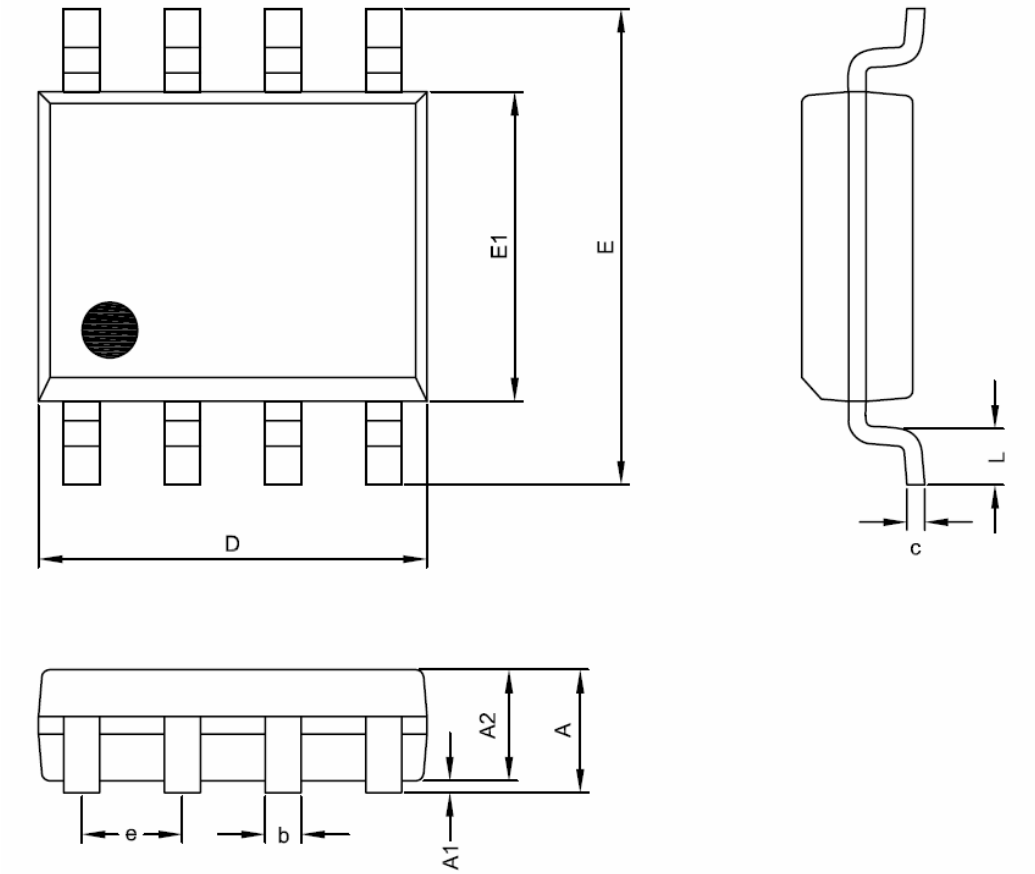



**Gate Charge**



## 8. Package Dimensions

### SOP- 8L




| Symbol | Dimensions In Millimeters | |
|---|---|---|
| | MIN. | MAX. |
| A | 1.35 | 1.75 |
| A1 | 0.00 | 0.25 |
| A2 | 1.15 | 1.50 |
| D | 4.80 | 5.00 |
| E | 5.80 | 6.20 |
| E1 | 3.80 | 4.00 |
| c | 0.19 | 0.27 |
| b | 0.33 | 0.53 |
| e | 1.27 BSC | |
| L | 0.40 | 1.27 |

Notes：

1. Jedec outline ： MS-012AA
2. Dimensions ” D ” does not include mold flash, protrusions and gate burrs shall not exceed .15 mm (.006 in) per side .
3. Dimensions “ E1 ” does not include inter-lead flash, or protrusions. Inter-lead flash and protrusions shall not exceed .25 mm (.010 in) per side.