

# Complementary Enhancement Mode MOSFET

## 1. Product Information

### 1.1 Features

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

### 1.2 Applications

- ☒ MB and NB
- ☒ Half – bridge Drivers
- ☒ Motor drivers

### 1.3 Quick reference

#### N-channel

- ☒  $BV \leq 40\text{ V}$
- ☒  $P_{\text{tot}} \leq 35\text{ W}$
- ☒  $I_D \leq 29\text{ A}$
- ☒  $R_{\text{DS(ON)}} \leq 27\text{ m}\Omega @ V_{\text{GS}} = 10\text{ V}$   
 $R_{\text{DS(ON)}} \leq 38\text{ m}\Omega @ V_{\text{GS}} = 4.5\text{ V}$

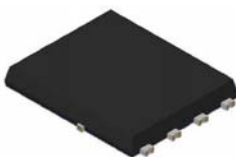
#### P-channel

- ☒  $BV \leq -40\text{ V}$
- ☒  $P_{\text{tot}} \leq 54\text{ W}$
- ☒  $I_D \leq -29\text{ A}$
- ☒  $R_{\text{DS(ON)}} \leq 43\text{ m}\Omega @ V_{\text{GS}} = -10\text{ V}$   
 $R_{\text{DS(ON)}} \leq 65\text{ m}\Omega @ V_{\text{GS}} = -4.5\text{ V}$

## 2. Pin Description

| Pin | Description | Simplified Outline | Symbol |
|-----|-------------|--------------------|--------|
| 1   | Source(S1)  |                    |        |
| 2   | Gate(G1)    |                    |        |
| 3   | Source(S2)  |                    |        |
| 4   | Gate(G2)    |                    |        |
| 5,6 | Drain(D2)   |                    |        |
| 7,8 | Drain(D1)   |                    |        |

Top View  
PDFN5x6-8L (Dual)



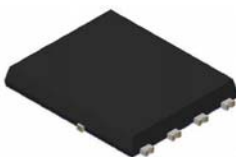
### 3. Limiting Values

| Symbol            | Parameter                               | Conditions                                                  | Min  | Max      | Unit                          |
|-------------------|-----------------------------------------|-------------------------------------------------------------|------|----------|-------------------------------|
| <b>N-channel</b>  |                                         |                                                             |      |          |                               |
| $V_{DS}$          | Drain-Source Voltage                    | $T_C = 25\text{ }^{\circ}\text{C}$                          | -    | 40       | V                             |
| $V_{GS}$          | Gate-Source Voltage                     | $T_C = 25\text{ }^{\circ}\text{C}$                          | -    | $\pm 20$ | V                             |
| $I_D^*$           | Drain Current                           | $T_C = 25\text{ }^{\circ}\text{C}, V_{GS} = 10\text{ V}$    | -    | 29       | A                             |
|                   |                                         | $T_C = 100\text{ }^{\circ}\text{C}, V_{GS} = 10\text{ V}$   | -    | 18       | A                             |
|                   |                                         | $T_A = 25\text{ }^{\circ}\text{C}, V_{GS} = 10\text{ V}$    | -    | 7        | A                             |
|                   |                                         | $T_A = 70\text{ }^{\circ}\text{C}, V_{GS} = 10\text{ V}$    | -    | 5.6      | A                             |
| $I_{DM}^{*,****}$ | Pulsed Drain Current                    | $T_C = 25\text{ }^{\circ}\text{C}, V_{GS} = 10\text{ V}$    | -    | 64       | A                             |
| $P_{tot}$         | Total Power Dissipation                 | $T_C = 25\text{ }^{\circ}\text{C}$                          | -    | 35       | W                             |
| $T_{stg}$         | Storage Temperature                     |                                                             | - 55 | 150      | $^{\circ}\text{C}$            |
| $T_J$             | Junction Temperature                    |                                                             | - 55 | 150      | $^{\circ}\text{C}$            |
| $R_{\theta JA}^*$ | Thermal Resistance- Junction to Ambient |                                                             | -    | 62.5     | $^{\circ}\text{C} / \text{W}$ |
| $R_{\theta JC}^*$ | Thermal Resistance- Junction to Case    |                                                             | -    | 3.5      | $^{\circ}\text{C} / \text{W}$ |
| <b>P-channel</b>  |                                         |                                                             |      |          |                               |
| $V_{DS}$          | Drain-Source Voltage                    | $T_C = 25\text{ }^{\circ}\text{C}$                          | -    | - 40     | V                             |
| $V_{GS}$          | Gate-Source Voltage                     | $T_C = 25\text{ }^{\circ}\text{C}$                          | -    | $\pm 20$ | V                             |
| $I_D^*$           | Drain Current                           | $T_C = 25\text{ }^{\circ}\text{C}, V_{GS} = - 10\text{ V}$  | -    | - 29     | A                             |
|                   |                                         | $T_C = 100\text{ }^{\circ}\text{C}, V_{GS} = - 10\text{ V}$ | -    | - 18     | A                             |
|                   |                                         | $T_A = 25\text{ }^{\circ}\text{C}, V_{GS} = - 10\text{ V}$  | -    | - 6.2    | A                             |
|                   |                                         | $T_A = 70\text{ }^{\circ}\text{C}, V_{GS} = - 10\text{ V}$  | -    | - 5      | A                             |
| $I_{DM}^{*,****}$ | Pulsed Drain Current                    | $T_C = 25\text{ }^{\circ}\text{C}, V_{GS} = - 10\text{ V}$  | -    | - 64     | A                             |
| $P_{tot}$         | Total Power Dissipation                 | $T_C = 25\text{ }^{\circ}\text{C}$                          | -    | 54       | W                             |
| $T_{stg}$         | Storage Temperature                     |                                                             | - 55 | 150      | $^{\circ}\text{C}$            |
| $T_J$             | Junction Temperature                    |                                                             | - 55 | 150      | $^{\circ}\text{C}$            |
| $R_{\theta JA}^*$ | Thermal Resistance- Junction to Ambient |                                                             | -    | 50       | $^{\circ}\text{C} / \text{W}$ |
| $R_{\theta JC}^*$ | Thermal Resistance- Junction to Case    |                                                             | -    | 2.3      | $^{\circ}\text{C} / \text{W}$ |

Notes :

- \* Surface Mounted on 1 in<sup>2</sup> pad area,  $t \leq 10\text{ sec}$
- \*\* Pulse width  $\leq 10\text{ }\mu\text{s}$ , duty cycle  $\leq 1\%$
- \*\*\* Limited by bonding wire

# iM1700



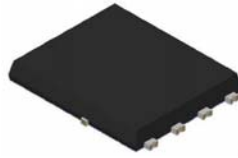
## 4. Marking Information

| Product Name | Marking                                   |
|--------------|-------------------------------------------|
| iM1700       | <div>iM1700<br/>XXXXX</div> X : Date Code |

## 5. Ordering Code

|                                  |                                                      |
|----------------------------------|------------------------------------------------------|
| iM1700□<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 ( $T_A = 25\text{ }^{\circ}\text{C}$ Unless Otherwise Noted)

### N-channel:

| Symbol                                   | Parameter                        | Conditions                                                                                                              | Min | Typ | Max  | Unit |
|------------------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----|-----|------|------|
| Static Characteristics                   |                                  |                                                                                                                         |     |     |      |      |
| BV <sub>DSS</sub>                        | Drain-Source Breakdown Voltage   | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                                                          | 40  | -   | -    | V    |
| V <sub>GS(th)</sub>                      | Gate Threshold Voltage           | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>DS</sub> = 250 μA                                                            | 1.4 | 1.8 | 2.3  | V    |
| I <sub>DSS</sub>                         | Zero Gate Voltage Source Current | V <sub>DS</sub> = 32 V, V <sub>GS</sub> = 0 V                                                                           | -   | -   | 1    | μA   |
|                                          |                                  | T <sub>J</sub> = 85 °C                                                                                                  | -   | -   | 30   | μA   |
| I <sub>GSS</sub>                         | Gate Leakage Current             | V <sub>GS</sub> = ± 20 V, V <sub>DS</sub> = 0 V                                                                         | -   | -   | ± 10 | uA   |
| R <sub>DS(ON)</sub> <sup>a</sup>         | Drain-Source On-State Resistance | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A                                                                           | -   | 21  | 27   | mΩ   |
|                                          |                                  | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 5 A                                                                           | -   | 29  | 38   |      |
| Diode Characteristics                    |                                  |                                                                                                                         |     |     |      |      |
| V <sub>SD</sub> <sup>a</sup>             | Diode Forward Voltage            | I <sub>SD</sub> = 10 A, V <sub>GS</sub> = 0 V                                                                           | -   | 0.8 | 1.3  | V    |
| t <sub>rr</sub>                          | Reverse Recovery Time            | I <sub>SD</sub> = 10 A, dI <sub>SD</sub> /dt = 100 A/μs                                                                 | -   | 6.4 | -    | nS   |
| Q <sub>rr</sub>                          | Reverse Recovery Charge          |                                                                                                                         | -   | 3.3 | -    | nC   |
| Dynamic Characteristics <sup>b</sup>     |                                  |                                                                                                                         |     |     |      |      |
| C <sub>iss</sub>                         | Input Capacitance                | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 20 V<br>Frequency = 1 MHz                                                      | -   | 658 | -    | pF   |
| C <sub>oss</sub>                         | Output Capacitance               |                                                                                                                         | -   | 44  | -    |      |
| C <sub>rss</sub>                         | Reverse Transfer Capacitance     |                                                                                                                         | -   | 40  | -    |      |
| t <sub>d(on)</sub>                       | Turn-on Delay Time               | V <sub>DS</sub> = 20 V, V <sub>GEN</sub> = 10 V,<br>R <sub>G</sub> = 6 Ω, R <sub>L</sub> = 2Ω,<br>I <sub>D</sub> = 10 A | -   | 5.2 | -    | nS   |
| t <sub>r</sub>                           | Turn-on Rise Time                |                                                                                                                         | -   | 18  | -    |      |
| t <sub>d(off)</sub>                      | Turn-off Delay Time              |                                                                                                                         | -   | 12  | -    |      |
| t <sub>f</sub>                           | Turn-off Fall Time               |                                                                                                                         | -   | 5   | -    |      |
| Gate Charge Characteristics <sup>b</sup> |                                  |                                                                                                                         |     |     |      |      |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>GS</sub> =10 V, V <sub>DS</sub> = 20 V,<br>I <sub>DS</sub> = 10 A                                                | -   | 12  | -    | nC   |
| Q <sub>gs</sub>                          | Gate-Source Charge               |                                                                                                                         | -   | 3.2 | -    |      |
| Q <sub>gd</sub>                          | Gate-Drain Charge                |                                                                                                                         | -   | 1.6 | -    |      |

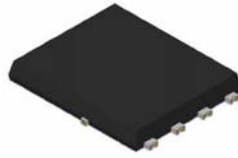
Notes :

a : Pulse test ; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$

b : Guaranteed by design, not subject to production testing

## 7. Electrical Characteristics ( $T_A = 25\text{ }^{\circ}\text{C}$ Unless Otherwise Noted)

# iM1700



## P-channel:

| Symbol                                   | Parameter                      | Conditions                                                                                                                          | Min.  | Typ.  | Max.  | Unit |
|------------------------------------------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-------|-------|------|
| Static Characteristics                   |                                |                                                                                                                                     |       |       |       |      |
| BV <sub>DSS</sub>                        | Drain-Source Breakdown Voltage | V <sub>GS</sub> = 0 V, I <sub>DS</sub> = - 250 μA                                                                                   | - 40  | -     | -     | V    |
| V <sub>GS(th)</sub>                      | Gate Threshold Voltage         | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>DS</sub> = - 250 μA                                                                      | - 1.4 | - 1.8 | - 2.3 | V    |
| I <sub>DSS</sub>                         | Drain Leakage Current          | V <sub>DS</sub> = - 32 V, V <sub>GS</sub> = 0 V                                                                                     | -     | -     | - 1.0 | μA   |
| I <sub>GSS</sub>                         | Gate Leakage Current           | V <sub>GS</sub> = 0 V, V <sub>GS</sub> = ± 20 V                                                                                     | -     | -     | ±100  | nA   |
| R <sub>DS(ON)</sub> <sup>a</sup>         | On-State Resistance            | V <sub>GS</sub> = - 10 V, I <sub>DS</sub> = - 7 A                                                                                   | -     | 34    | 43    | mΩ   |
|                                          |                                | V <sub>GS</sub> = - 4.5 V, I <sub>DS</sub> = - 4 A                                                                                  | -     | 50    | 65    |      |
| Diode Characteristics                    |                                |                                                                                                                                     |       |       |       |      |
| V <sub>SD</sub> <sup>a</sup>             | Diode Forward Voltage          | I <sub>SD</sub> = - 7 A, V <sub>GS</sub> = 0 V                                                                                      | -     | - 0.8 | - 1.3 | V    |
| t <sub>rr</sub>                          | Reverse Recovery Time          | I <sub>SD</sub> = - 7 A, dI <sub>SD</sub> / dt = 100 A / μs                                                                         | -     | 15    | -     | nS   |
| Q <sub>rr</sub>                          | Reverse Recovery Charge        |                                                                                                                                     | -     | 10    | -     | nC   |
| Dynamic Characteristics <sup>b</sup>     |                                |                                                                                                                                     |       |       |       |      |
| C <sub>iss</sub>                         | Input Capacitance              | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = - 20 V<br>Frequency = 1 MHz                                                                | -     | 1094  | -     | pF   |
| C <sub>oss</sub>                         | Output Capacitance             |                                                                                                                                     | -     | 80    | -     |      |
| C <sub>rss</sub>                         | Reverse Transfer Capacitance   |                                                                                                                                     | -     | 73    | -     |      |
| t <sub>d(on)</sub>                       | Turn-on Delay Time             | V <sub>DS</sub> = - 20 V, V <sub>GEN</sub> = - 10 V,<br>R <sub>G</sub> = 3.3 Ω, R <sub>L</sub> = 2.85 Ω,<br>I <sub>DS</sub> = - 7 A | -     | 16    | -     | nS   |
| t <sub>r</sub>                           | Turn-on Rise Time              |                                                                                                                                     | -     | 32    | -     |      |
| t <sub>d(off)</sub>                      | Turn-off Delay Time            |                                                                                                                                     | -     | 131   | -     |      |
| t <sub>f</sub>                           | Turn-off Fall Time             |                                                                                                                                     | -     | 62    | -     |      |
| Gate Charge Characteristics <sup>b</sup> |                                |                                                                                                                                     |       |       |       |      |
| Q <sub>g</sub>                           | Total Gate Charge              | V <sub>DS</sub> = - 20 V, V <sub>GS</sub> = - 10 V,<br>I <sub>DS</sub> = - 7 A                                                      | -     | 19    | -     | nC   |
| Q <sub>gs</sub>                          | Gate-Source Charge             |                                                                                                                                     | -     | 5     | -     |      |
| Q <sub>gd</sub>                          | Gate-Drain Charge              |                                                                                                                                     | -     | 2.9   | -     |      |

Notes :

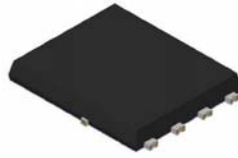
a : Pulse test ; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$

b : Guaranteed by design, not subject to production testing

## 8. Typical Characteristics (Cont.)

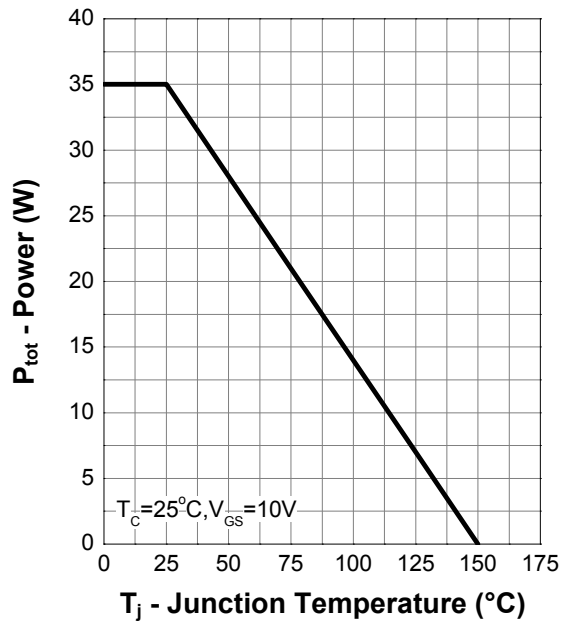
5

# iM1700

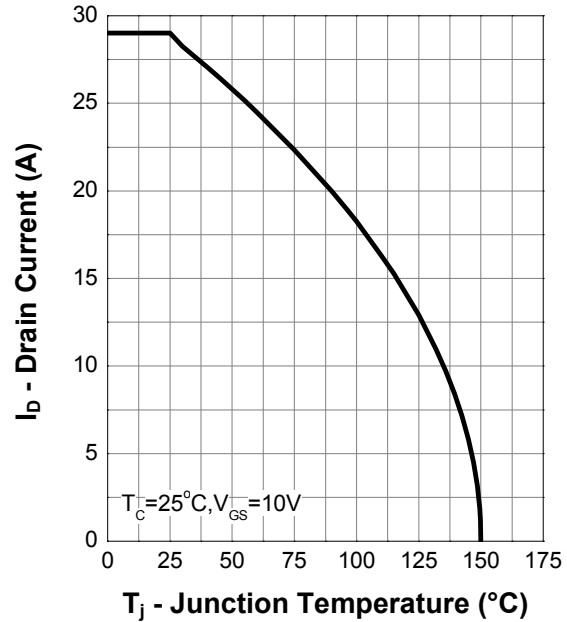


## N-channel:

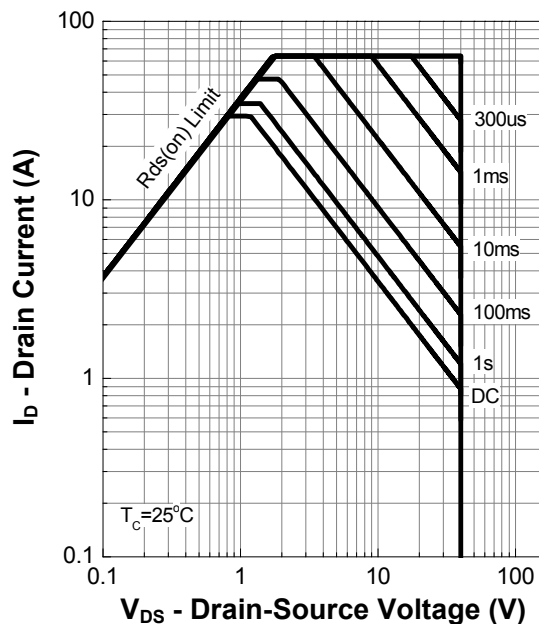
**Power Capability**



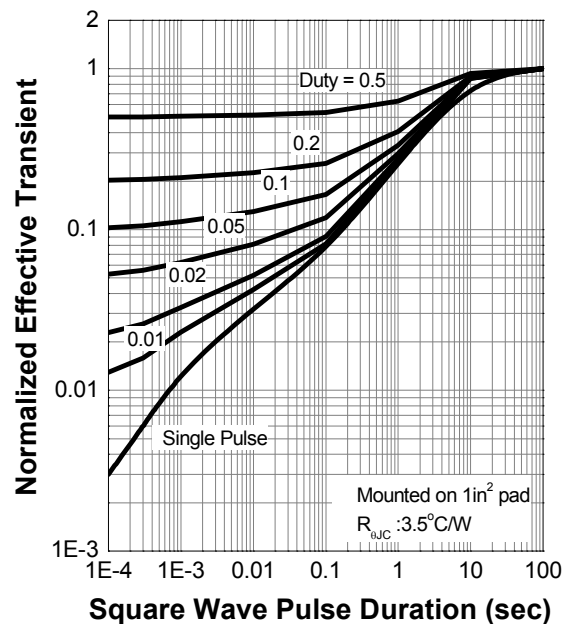
**Current Capability**

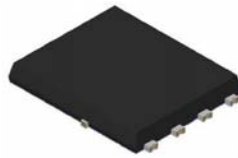


**Safe Operation Area**



**Transient Thermal Impedance**

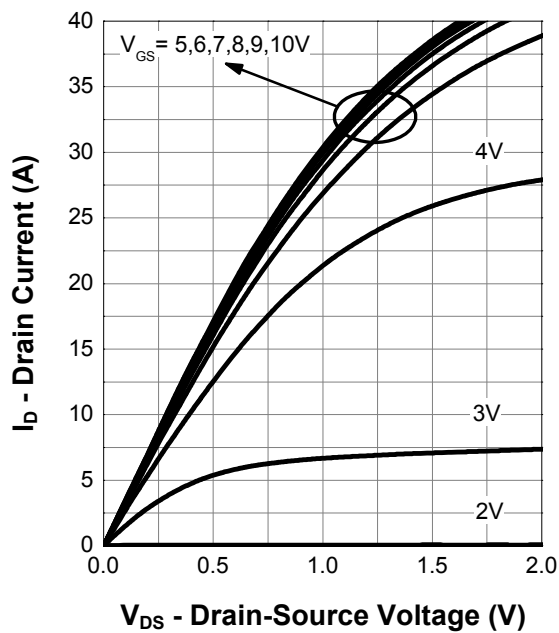




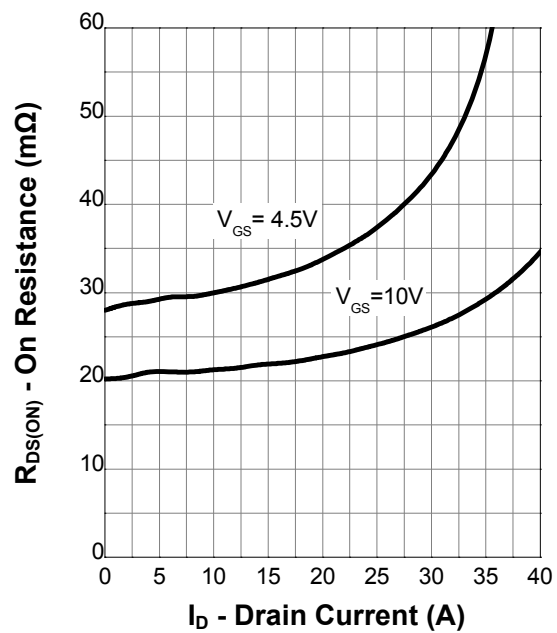
## 8. Typical Characteristics (Cont.)

N-channel:

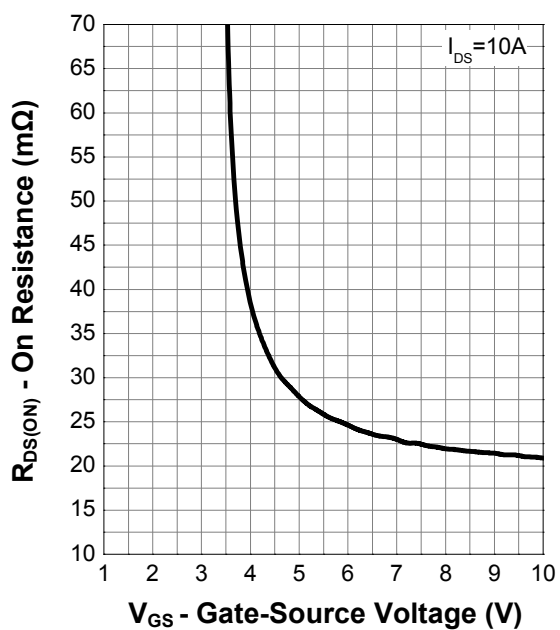
Output Characteristics



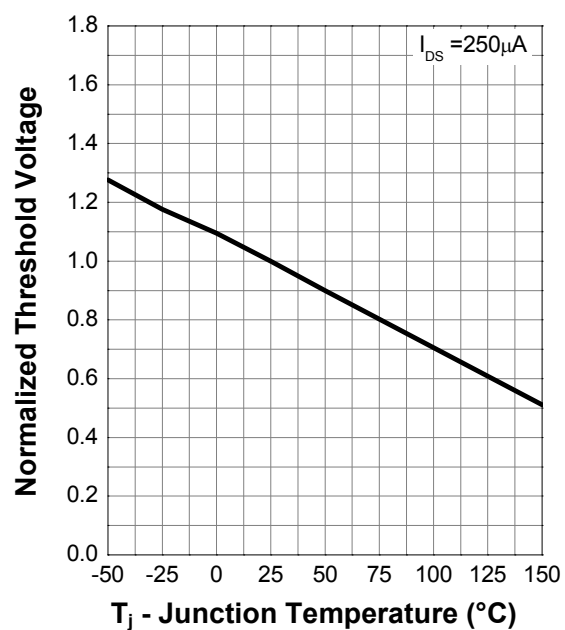
On Resistance

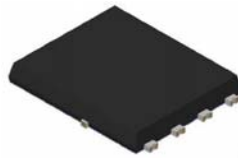


Transfer Characteristics



Normalized Threshold Voltage

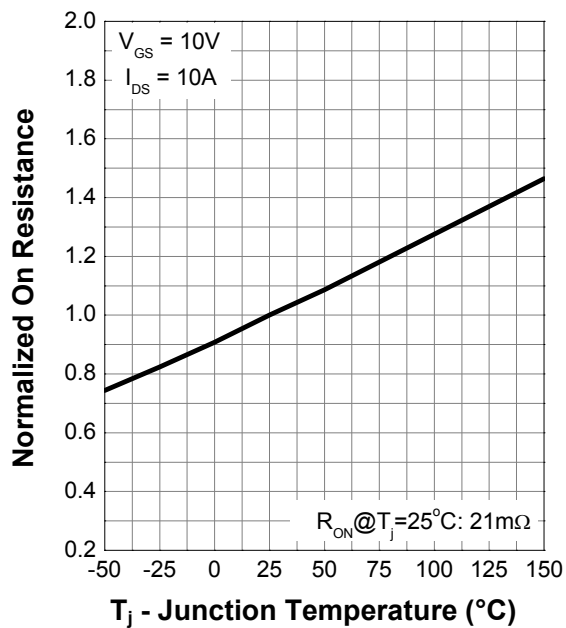




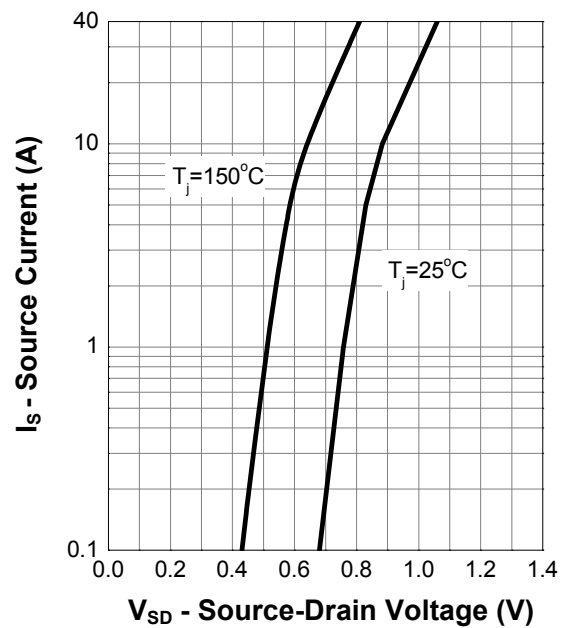
## 8. Typical Characteristics (Cont.)

N-channel:

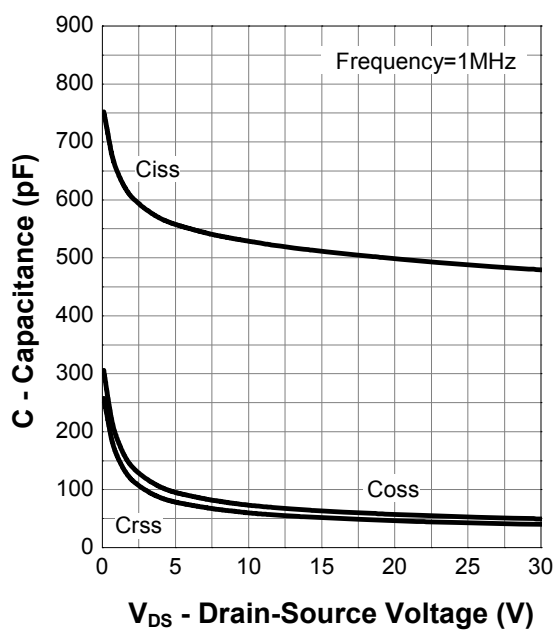
Normalized On Resistance



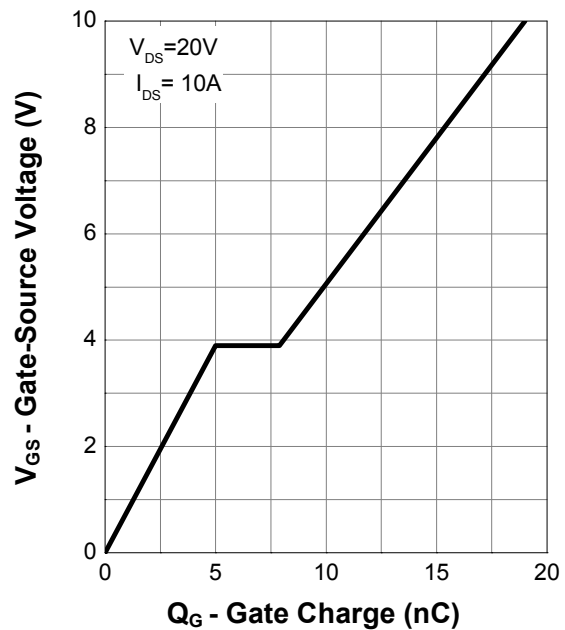
Diode Forward Current

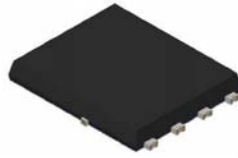


Capacitance



Gate Charge

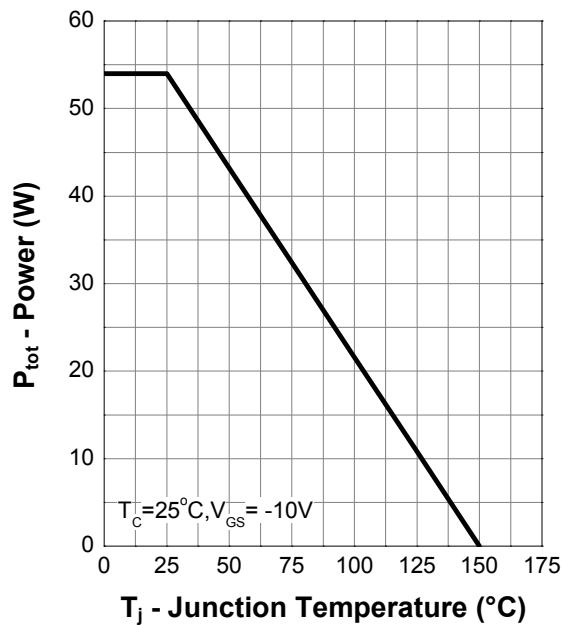




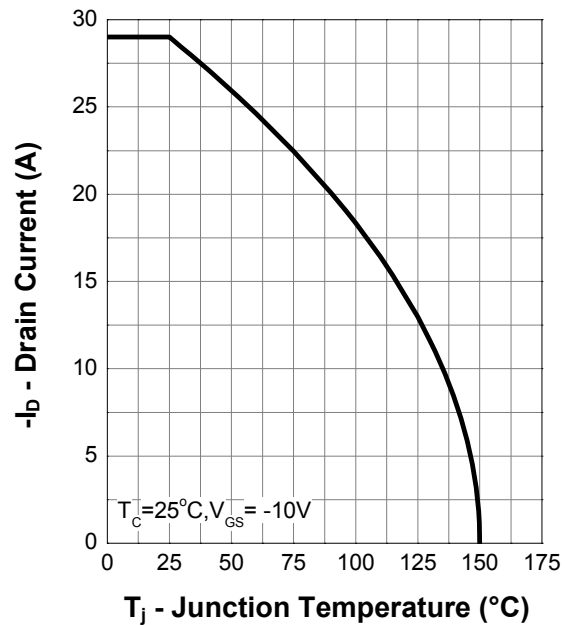
## 8. Typical Characteristics (Cont.)

P-channel:

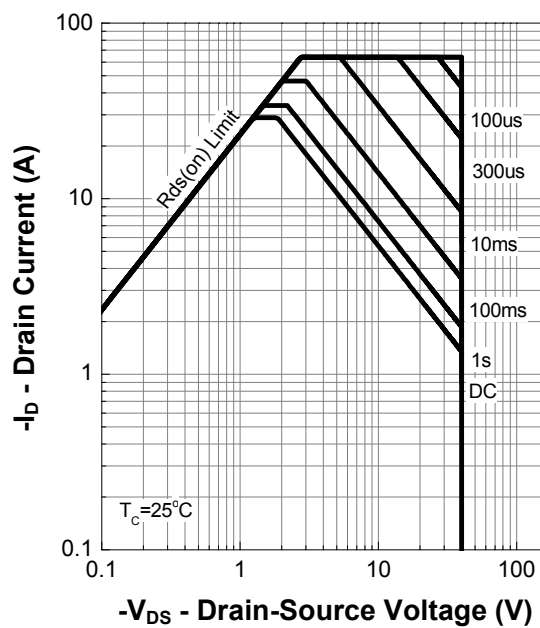
Power Capability



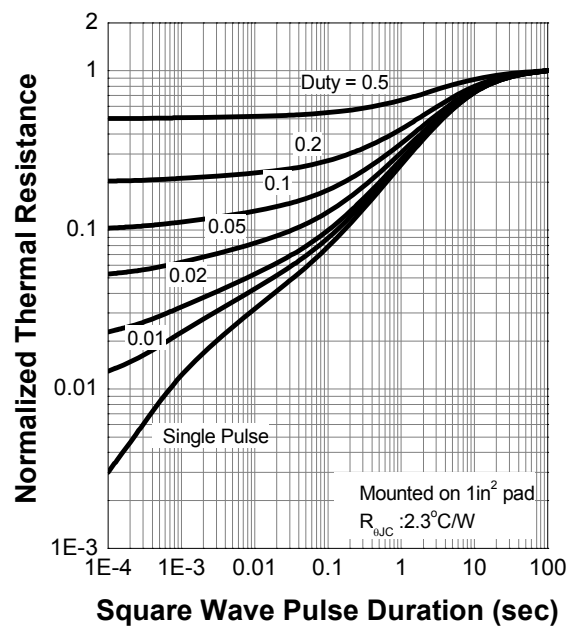
Current Capability

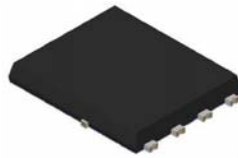


Safe Operation Area



Transient Thermal Impedance

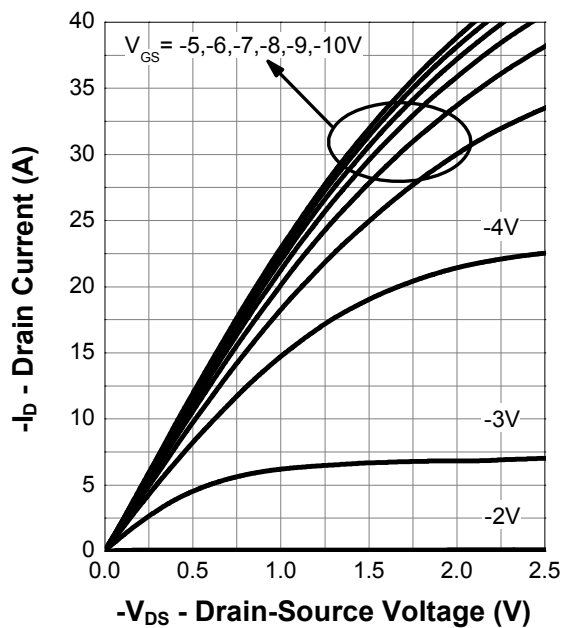




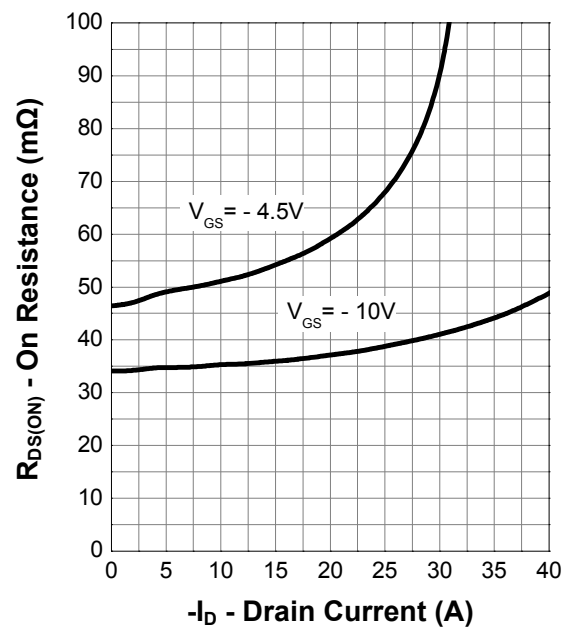
## 8. Typical Characteristics (Cont.)

P-channel:

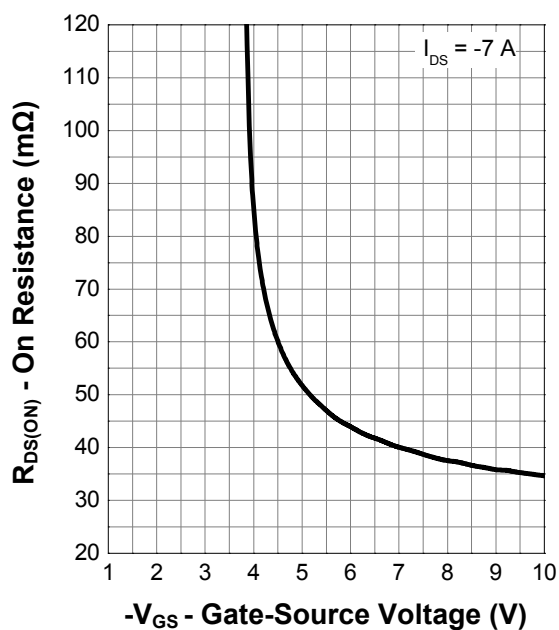
Output Characteristics



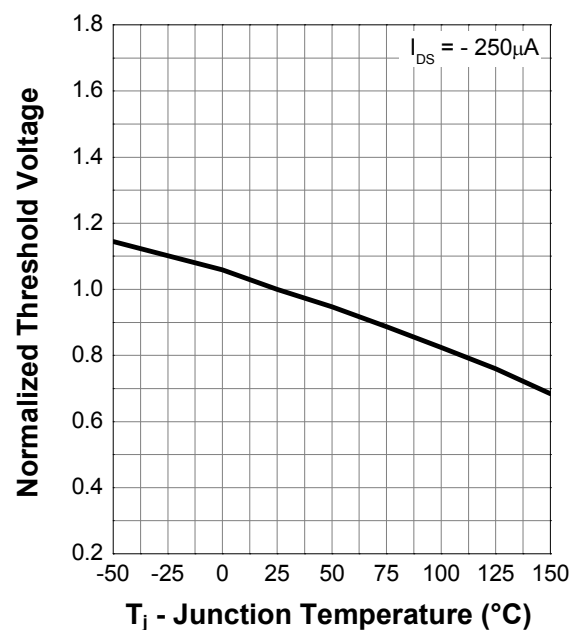
Drain-Source On Resistance

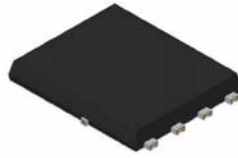


Transfer Characteristics



Normalized Threshold Voltage

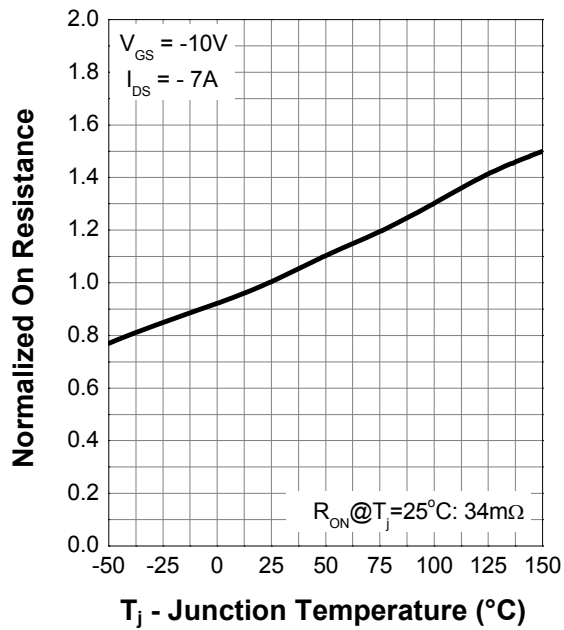




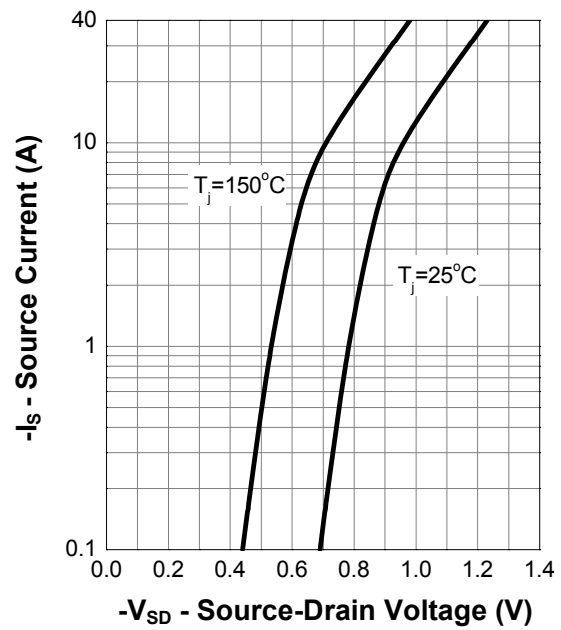
## 8. Typical Characteristics (Cont.)

P-channel:

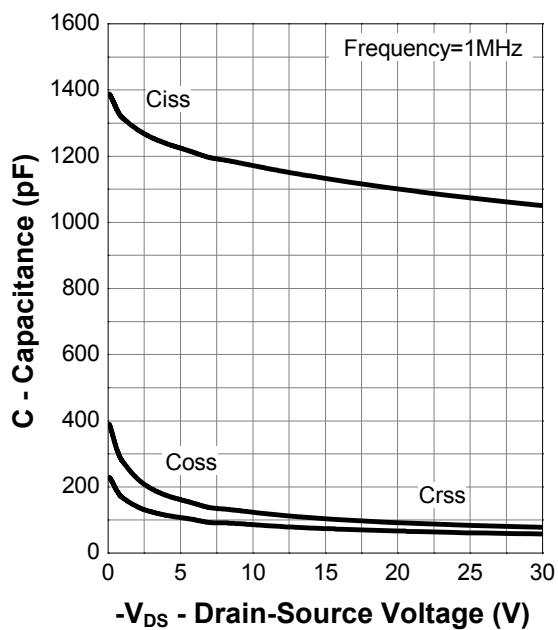
Normalized On Resistance



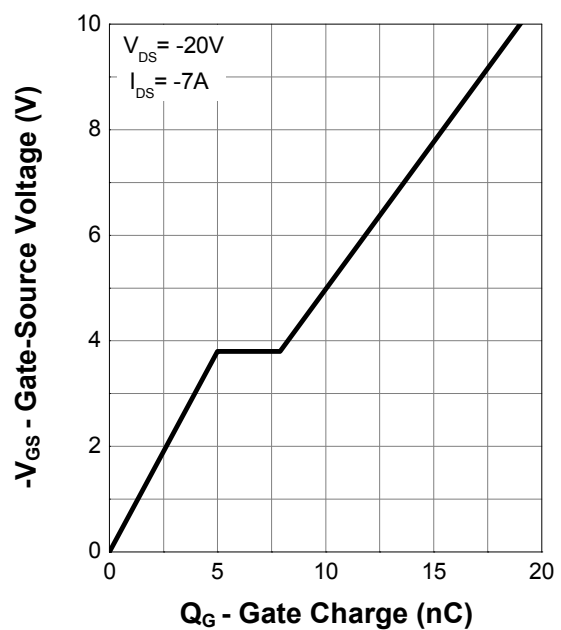
Diode Forward Current

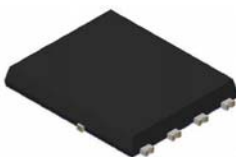


Capacitance



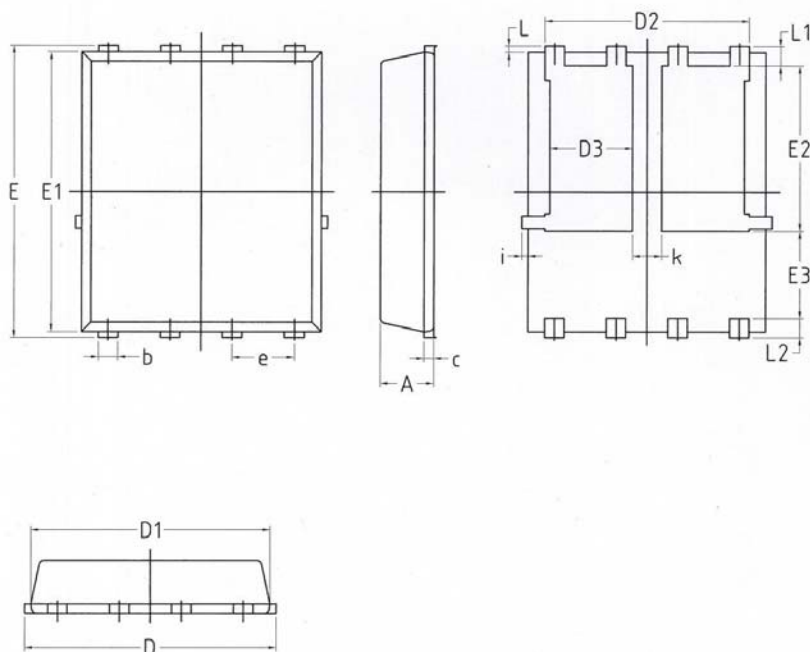
Gate Charge





## 9. Package Dimensions

### PDFN5x6 - 8L (Dual) Package



| Symbol | Dimensions In Millimeters |      |
|--------|---------------------------|------|
|        | MIN.                      | MAX. |
| A      | 1.03                      | 1.17 |
| B      | 0.34                      | 0.48 |
| c      | 0.203 BSC                 |      |
| D      | 4.8                       | 5.4  |
| D1     | 4.8                       | 5.0  |
| D2     | 4.11                      | 4.31 |
| D3     | 1.6                       | 1.8  |
| E      | 5.95                      | 6.15 |
| E1     | 5.65                      | 5.85 |
| E2     | 3.3                       | 3.5  |
| E3     | 1.7                       | -    |
| e      | 1.27 BSC                  |      |
| L      | 0.05                      | 0.25 |
| L1     | 0.38                      | 0.5  |
| L2     | 0.38                      | 0.5  |
| i      | -                         | 0.18 |
| k      | 0.5                       | 0.7  |