

# Complementary Enhancement Mode MOSFET

## 1. Product Information

### 1.1 Features

- Surface-mounted package
- Advanced trench cell design

### 1.2 Applications

- MB and NB
- Motor drivers
- Half – bridge Drivers
- ESD cell protected

### 1.3 Quick reference N-channel

- $BV \leq 30\text{ V}$
- $P_{tot} \leq 2\text{ W}$
- $I_D \leq 6.9\text{ A}$
- $R_{DS(ON)} \leq 28\text{ m}\Omega @ V_{GS} = 10\text{ V}$   
 $R_{DS(ON)} \leq 42\text{ m}\Omega @ V_{GS} = 4.5\text{ V}$

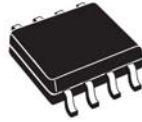
### P-channel

- $BV \leq -30\text{ V}$
- $P_{tot} \leq 2\text{ W}$
- $I_D \leq -5\text{ A}$
- $R_{DS(ON)} \leq 50\text{ m}\Omega @ V_{GS} = -10\text{ V}$   
 $R_{DS(ON)} \leq 80\text{ m}\Omega @ V_{GS} = -4.5\text{ V}$

## 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)		
1,2	Drain(D1)		
3,4	Drain(D2)		

Top View  
SOP-8L



### 3. Marking Information

Product Name	Marking
iM4710	<div style="border: 1px solid black; padding: 2px; display: inline-block;">iM4710 XXXXX</div> <span style="margin-left: 20px;">X : Date Code</span>

### 4. Ordering Code

iM4710 <input type="checkbox"/> Assembly Material	Assembly Material G: Halogen and Lead Free Device
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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)

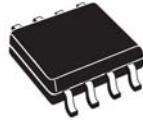
### 5. Limiting Values

Symbol	Parameter	Conditions	Min	Max	Unit
<b>N-channel</b>					
$V_{DS}$	Drain-Source Voltage	$T_A = 25\text{ }^\circ\text{C}$	-	30	V
$V_{GS}$	Gate-Source Voltage	$T_A = 25\text{ }^\circ\text{C}$	-	$\pm 20$	V
$I_D^*$	Drain Current	$T_A = 25\text{ }^\circ\text{C}, V_{GS} = -10\text{ V}$	-	6.9	A
		$T_A = 100\text{ }^\circ\text{C}, V_{GS} = -10\text{ V}$	-	4.3	A
$I_{DM}^{***}$	Pulsed Drain Current	$T_A = 25\text{ }^\circ\text{C}, V_{GS} = -10\text{ V}$	-	28	A
<b>P-channel</b>					
$V_{DS}$	Drain-Source Voltage	$T_A = 25\text{ }^\circ\text{C}$	-	- 30	V
$V_{GS}$	Gate-Source Voltage	$T_A = 25\text{ }^\circ\text{C}$	-	$\pm 20$	V
$I_D^*$	Drain Current	$T_A = 25\text{ }^\circ\text{C}, V_{GS} = -10\text{ V}$	-	- 5	A
		$T_A = 100\text{ }^\circ\text{C}, V_{GS} = -10\text{ V}$	-	- 3.2	A
$I_{DM}^{***}$	Pulsed Drain Current	$T_A = 25\text{ }^\circ\text{C}, V_{GS} = -10\text{ V}$	-	- 20	A
$P_{tot}$	Total Power Dissipation	$T_A = 25\text{ }^\circ\text{C}$	-	2	W
$T_{stg}$	Storage Temperature		- 55	150	$^\circ\text{C}$
$T_J$	Junction Temperature		- 55	150	$^\circ\text{C}$
$I_S$	Diode Forward Current	$T_A = 25\text{ }^\circ\text{C}$	-	2	A
$R_{\theta JA}^*$	Thermal Resistance- Junction to Ambient		-	62.5	$^\circ\text{C} / \text{W}$

Notes :

\* Surface Mounted on 1 in<sup>2</sup> pad area,  $t \leq 10\text{ sec}$

\*\* Pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$



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

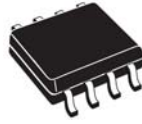
### N-channel:

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_{DS} = 250\text{ }\mu\text{A}$	30	-	-	V
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{DS} = 250\text{ }\mu\text{A}$	1	1.5	2	V
$I_{DSS}$	Drain Leakage Current	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	$\mu\text{A}$
		$T_J = 85\text{ }^\circ\text{C}$	-	-	30	$\mu\text{A}$
$I_{GSS}$	Gate Leakage Current	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	-	-	$\pm 10$	$\mu\text{A}$
$R_{DS(ON)}^a$	On-State Resistance	$V_{GS} = 10\text{ V}, I_{DS} = 6.9\text{ A}$	-	22	28	m $\Omega$
		$V_{GS} = 4.5\text{ V}, I_{DS} = 5\text{ A}$	-	31	42	
<b>Diode Characteristics</b>						
$V_{SD}^a$	Diode Forward Voltage	$I_{SD} = 1\text{ A}, V_{GS} = 0\text{ V}$	-	0.8	1.1	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 6.9\text{ A}, dI_{SD}/dt = 100\text{ A}/\mu\text{s}$	-	15	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	7	-	nC
<b>Dynamic Characteristics<sup>b</sup></b>						
$R_G$	Gate Resistance	$V_{GS} = V_{DS} = 0\text{ V}, F = 1\text{ MHz}$	-	5	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 15\text{ V}$ Frequency = 1 MHz	-	600	-	pF
$C_{oss}$	Output Capacitance		-	90	-	
$C_{rss}$	Reverse Transfer Capacitance		-	60	-	
$t_d(on)$	Turn-on Delay Time	$V_{DS} = 15\text{ V}, V_{GEN} = 10\text{ V},$ $R_G = 6\text{ }\Omega, R_L = 15\text{ }\Omega,$ $I_{DS} = 1\text{ A}$	-	6	14	ns
$t_r$	Turn-on Rise Time		-	9	18	
$t_d(off)$	Turn-off Delay Time		-	25	48	
$t_f$	Turn-off Fall Time		-	4	7	
<b>Gate Charge Characteristics<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V},$ $I_{DS} = 6.9\text{ A}$	-	13	19	nC
$Q_{gs}$	Gate-Source Charge		-	1.25	-	
$Q_{gd}$	Gate-Drain Charge		-	2.6	-	

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)

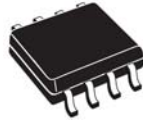
### P-channel:

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static Characteristics						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$ , $I_{DS} = -250\text{ }\mu\text{A}$	-30	-	-	V
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_{DS} = -250\text{ }\mu\text{A}$	-1	-1.5	-2	V
$I_{DSS}$	Drain Leakage Current	$V_{DS} = -24\text{ V}$ , $V_{GS} = 0\text{ V}$	-	-	-1	$\mu\text{A}$
		$T_J = 85\text{ }^\circ\text{C}$	-	-	-30	$\mu\text{A}$
$I_{GSS}$	Gate Leakage Current	$V_{GS} = \pm 16\text{ V}$ , $V_{DS} = 0\text{ V}$	-	-	$\pm 10$	$\mu\text{A}$
$R_{DS(ON)}^a$	On-State Resistance	$V_{GS} = -10\text{ V}$ , $I_{DS} = -5\text{ A}$	-	40	50	m $\Omega$
		$V_{GS} = -4.5\text{ V}$ , $I_{DS} = -4\text{ A}$	-	60	80	
Diode Characteristics						
$V_{SD}^a$	Diode Forward Voltage	$I_{SD} = -1\text{ A}$ , $V_{GS} = 0\text{ V}$	-	-0.8	-1.1	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = -5\text{ A}$ , $dI_{SD}/dt = 100\text{ A}/\mu\text{s}$	-	16	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	7	-	nC
Dynamic Characteristics <sup>b</sup>						
$R_G$	Gate Resistance	$V_{GS} = V_{DS} = 0\text{ V}$ , $F = 1\text{ MHz}$	-	8	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{ V}$ , $V_{DS} = -15\text{ V}$ Frequency = 1 MHz	-	720	-	pF
$C_{oss}$	Output Capacitance		-	110	-	
$C_{rss}$	Reverse Transfer Capacitance		-	60	-	
$t_d(on)$	Turn-on Delay Time	$V_{DS} = -15\text{ V}$ , $V_{GEN} = -10\text{ V}$ , $R_G = 6\text{ }\Omega$ , $R_L = 15\text{ }\Omega$ , $I_{DS} = -1\text{ A}$	-	9	18	ns
$t_r$	Turn-on Rise Time		-	12	22	
$t_d(off)$	Turn-off Delay Time		-	32	60	
$t_f$	Turn-off Fall Time		-	12	24	
Gate Charge Characteristics <sup>b</sup>						
$Q_g$	Total Gate Charge	$V_{GS} = -10\text{ V}$ , $V_{DS} = -15\text{ V}$ , $I_{DS} = -5\text{ A}$	-	12	18	nC
$Q_{gs}$	Gate-Source Charge		-	1.3	-	
$Q_{gd}$	Gate-Drain Charge		-	2.5	-	

Notes :

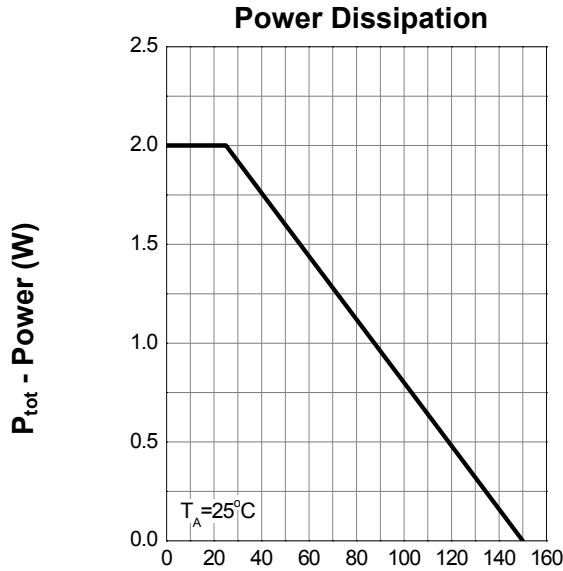
a : Pulse test ; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$

b : Guaranteed by design, not subject to production testing

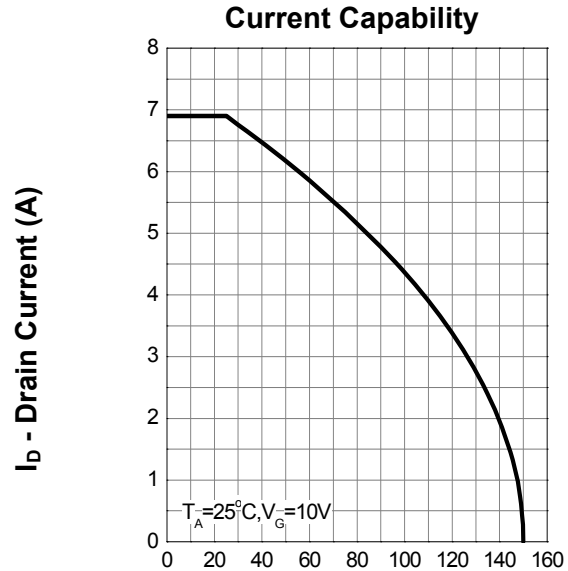


## 8. Typical Characteristics

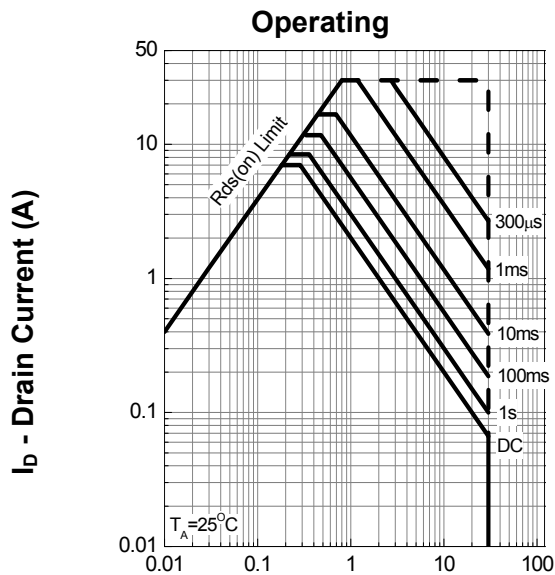
N-channel:



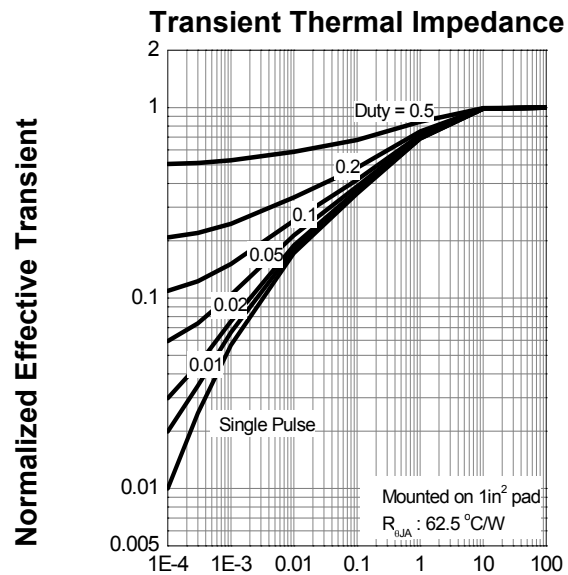
$T_j$  - Junction Temperature ( $^{\circ}C$ )



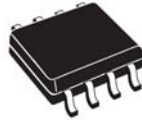
$T_j$  - Junction Temperature ( $^{\circ}C$ )



$V_{DS}$  - Drain-Source Voltage (V)

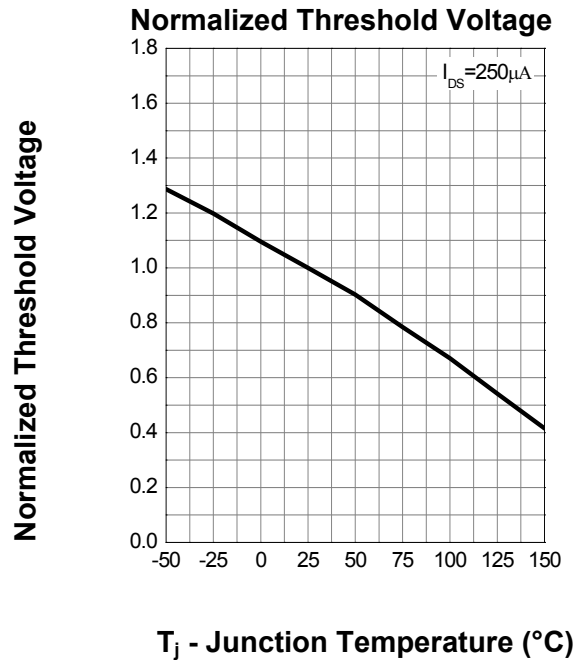
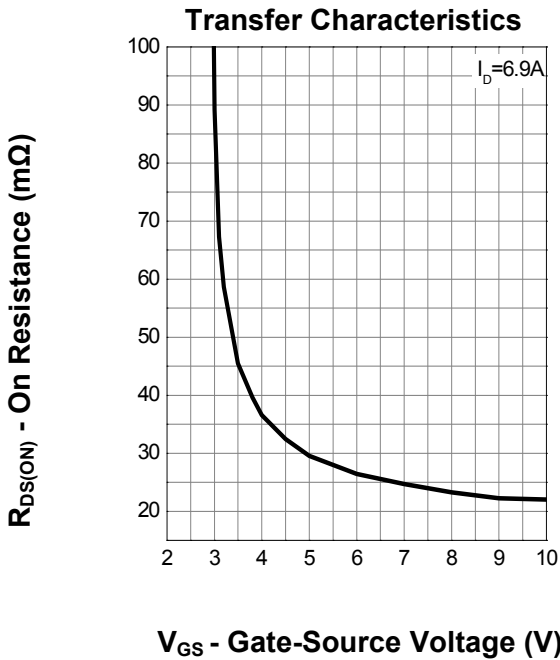
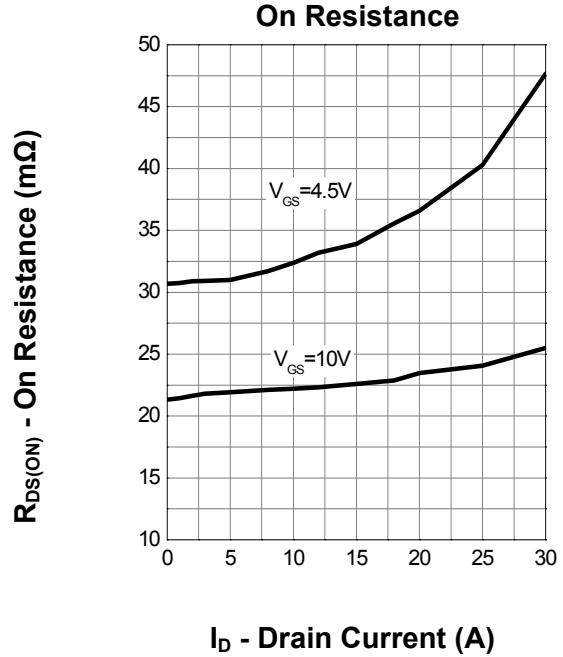
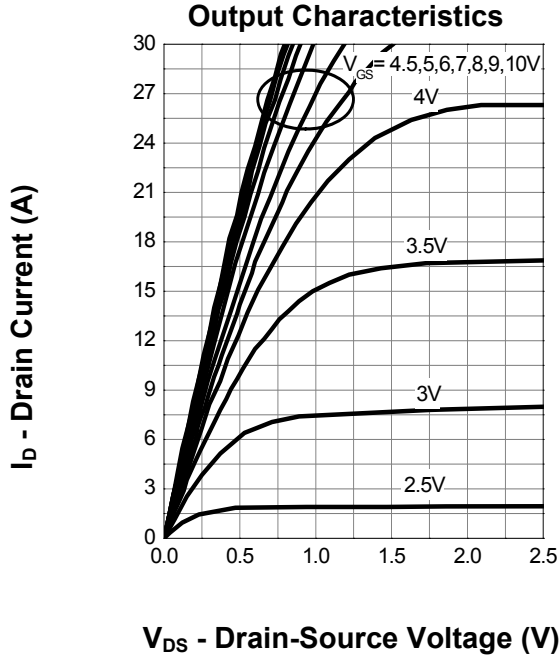


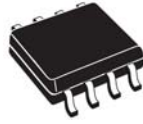
Square Wave Pulse Duration (sec)



## 8. Typical Characteristics (cont.)

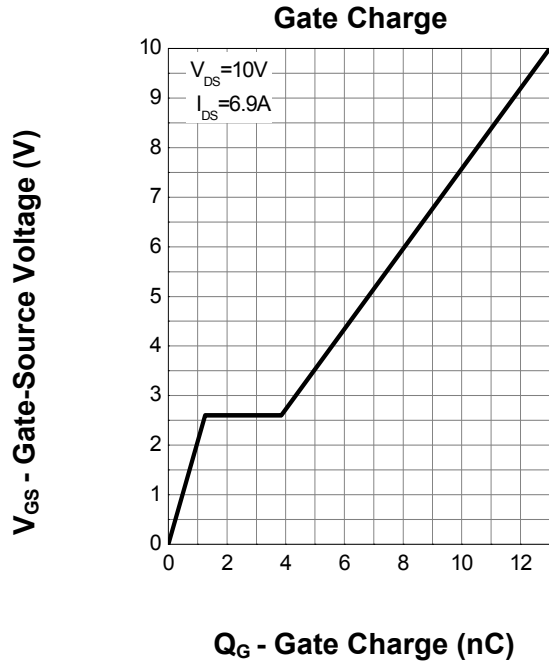
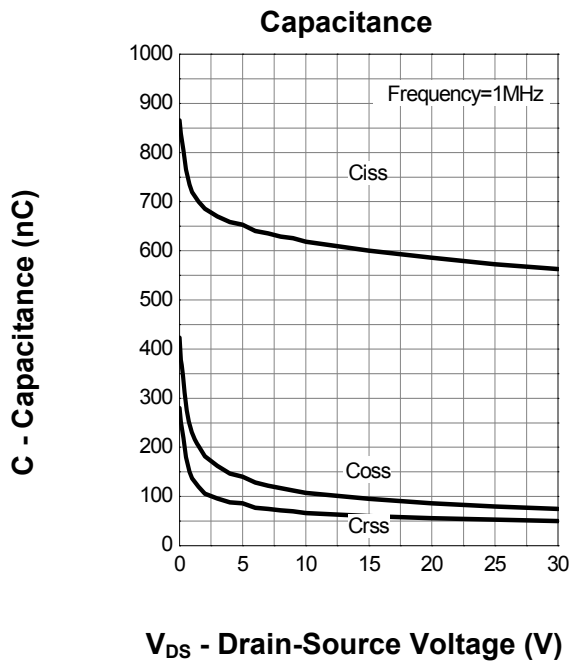
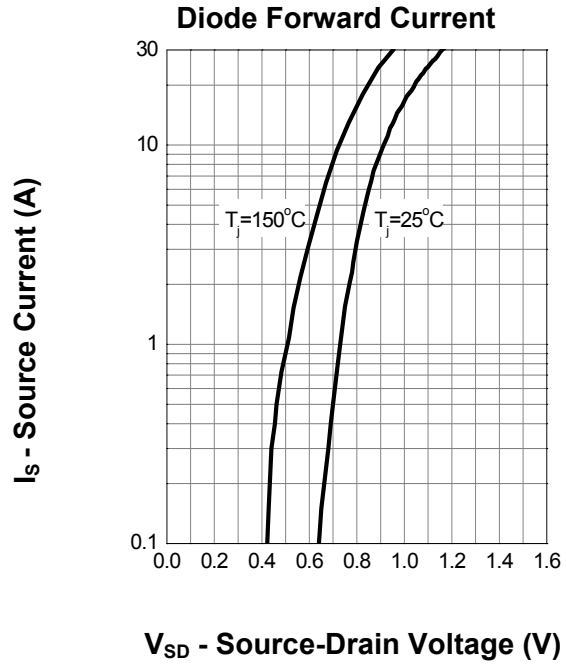
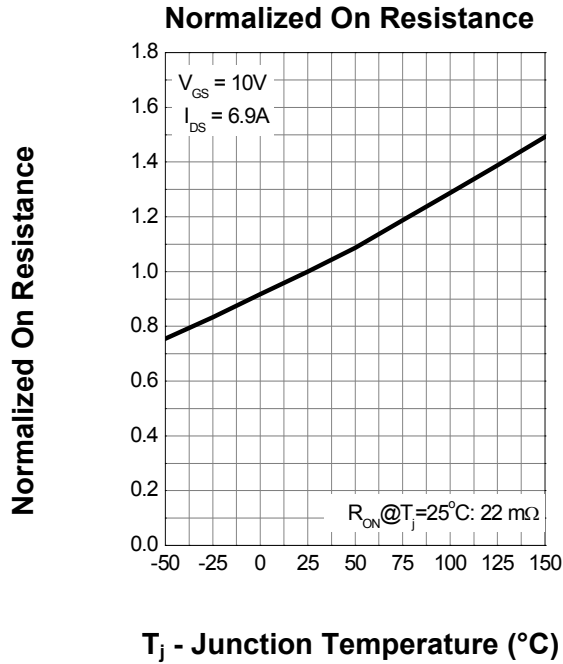
N-channel:

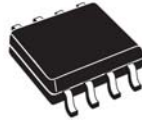




## 8. Typical Characteristics (cont.)

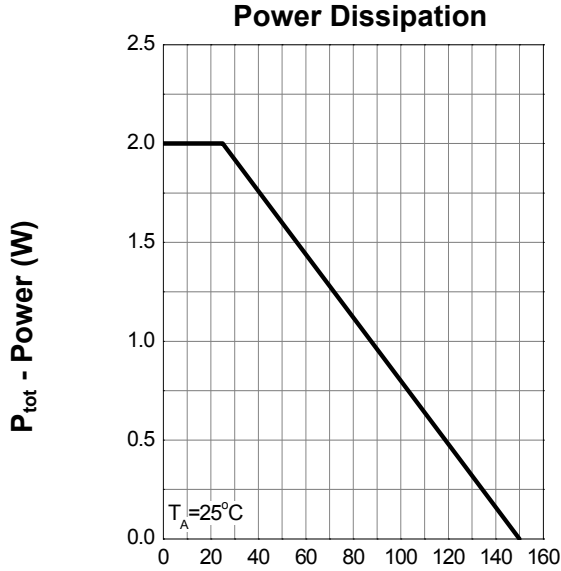
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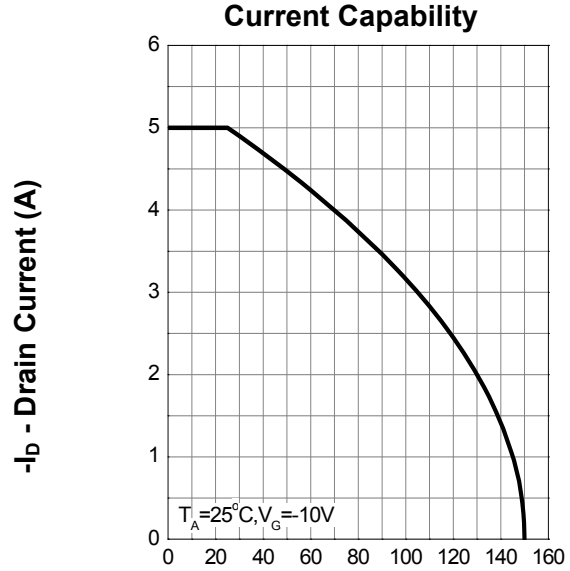


## 8. Typical Characteristics (cont.)

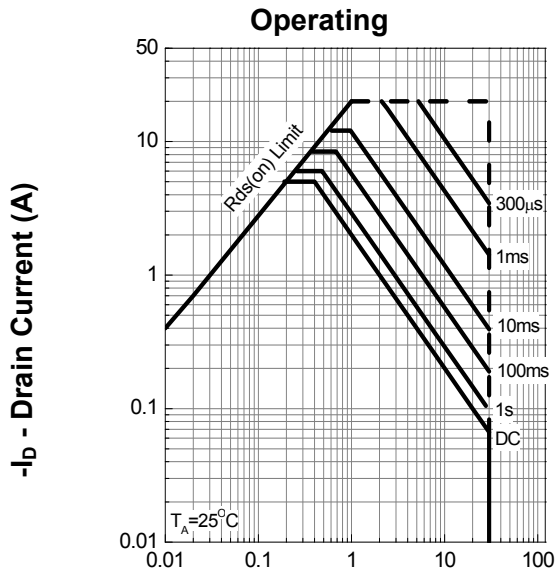
P-channel:



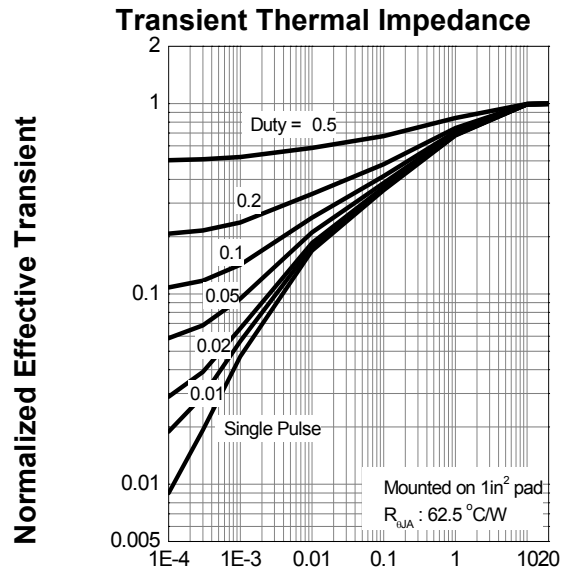
$T_j$  - Junction Temperature ( $^{\circ}C$ )



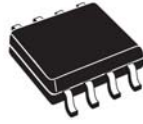
$T_j$  - Junction Temperature ( $^{\circ}C$ )



$-V_{DS}$  - Drain-Source Voltage (V)

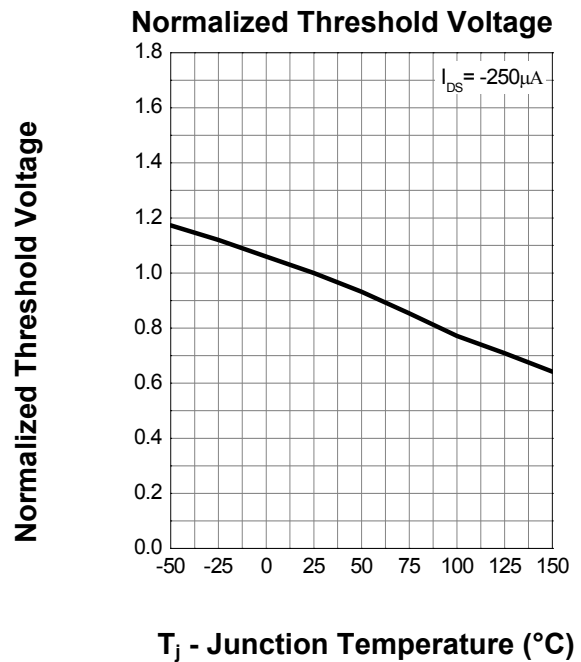
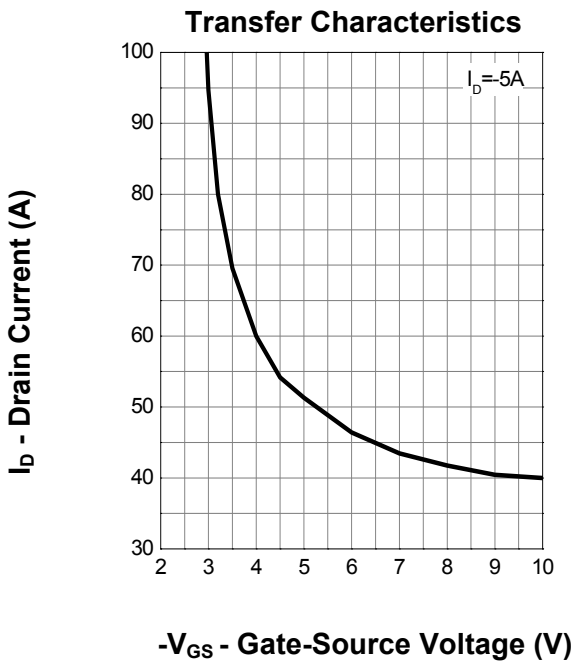
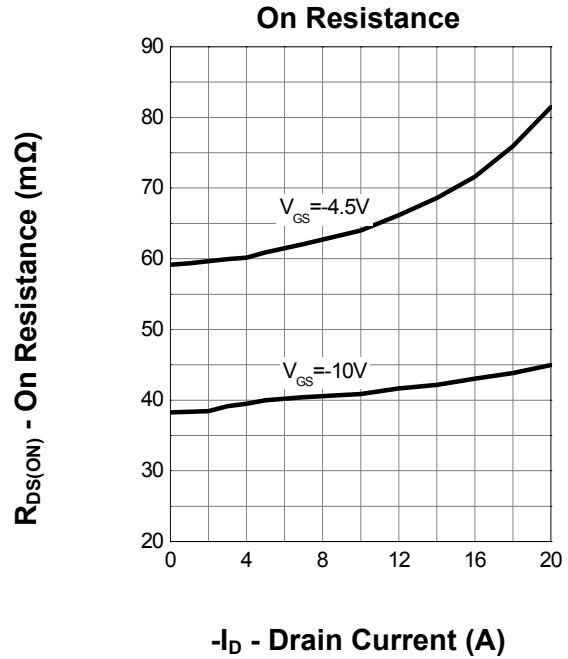
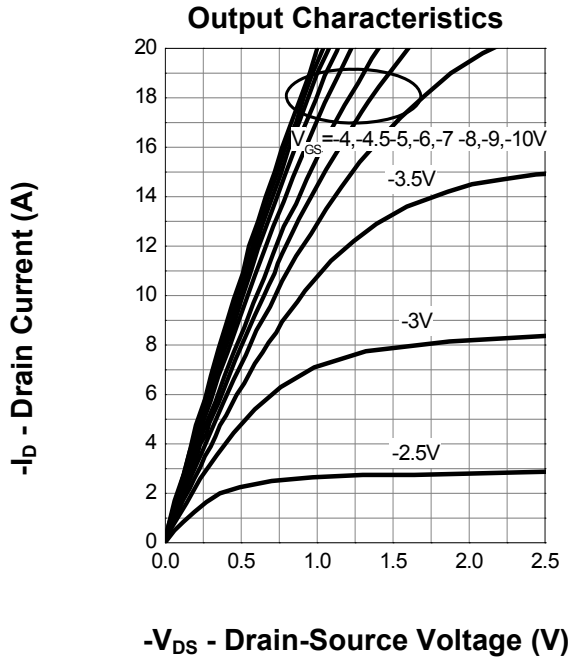


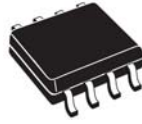
Square Wave Pulse Duration (sec)



## 8. Typical Characteristics (cont.)

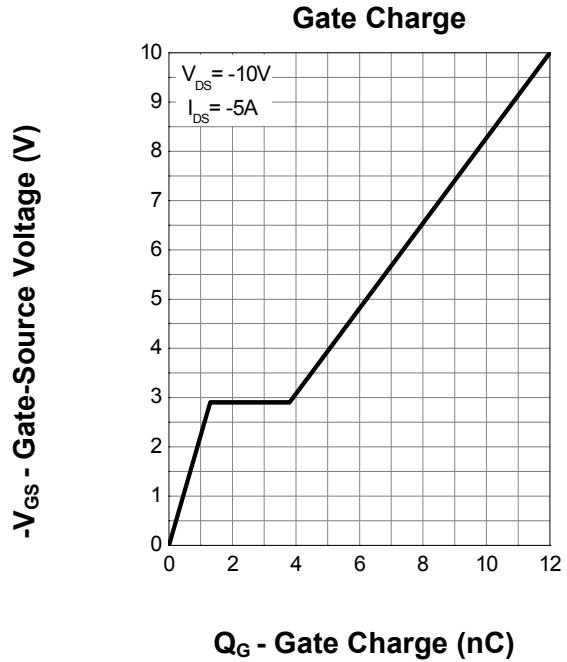
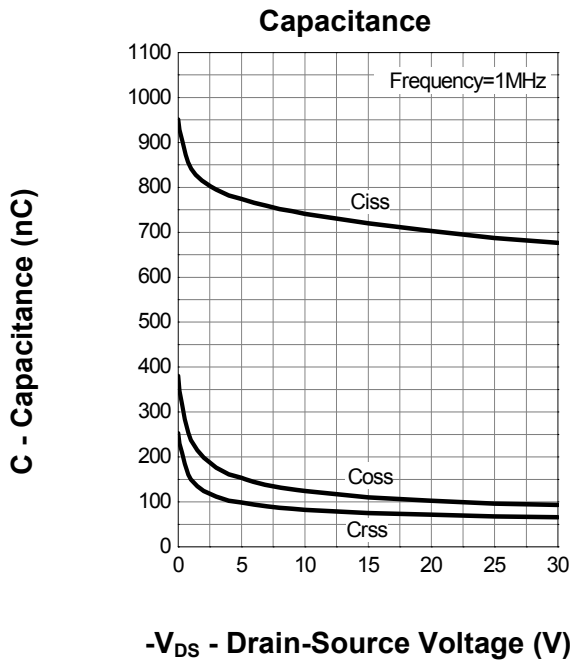
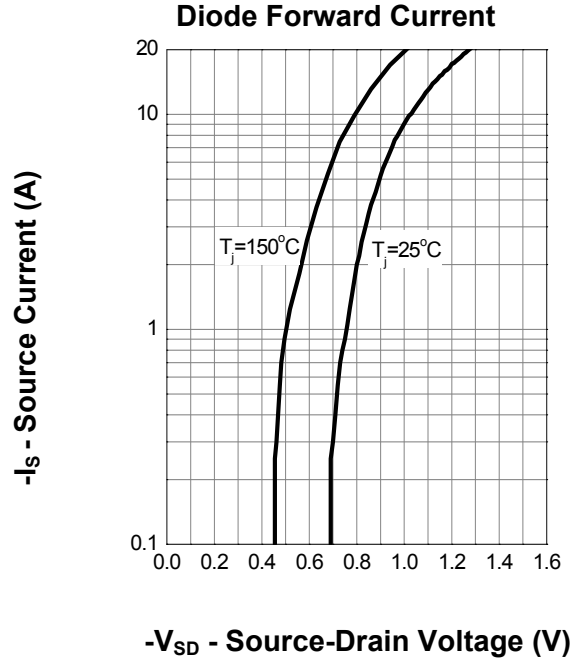
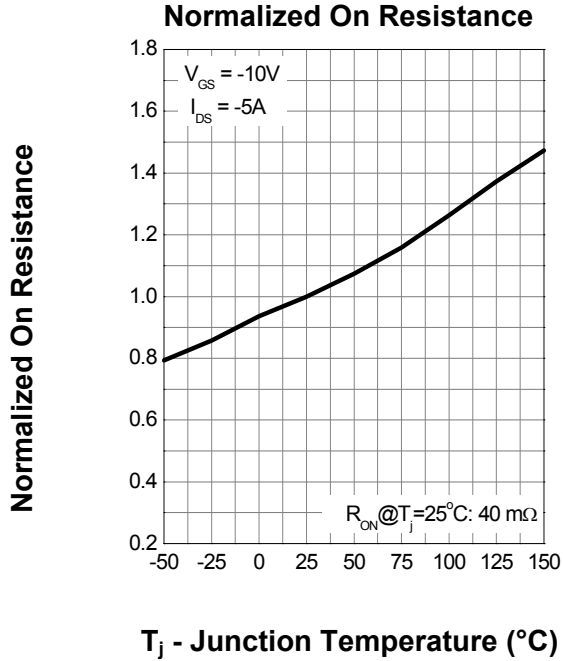
P-channel:

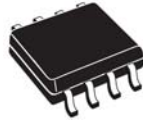




## 8. Typical Characteristics (cont.)

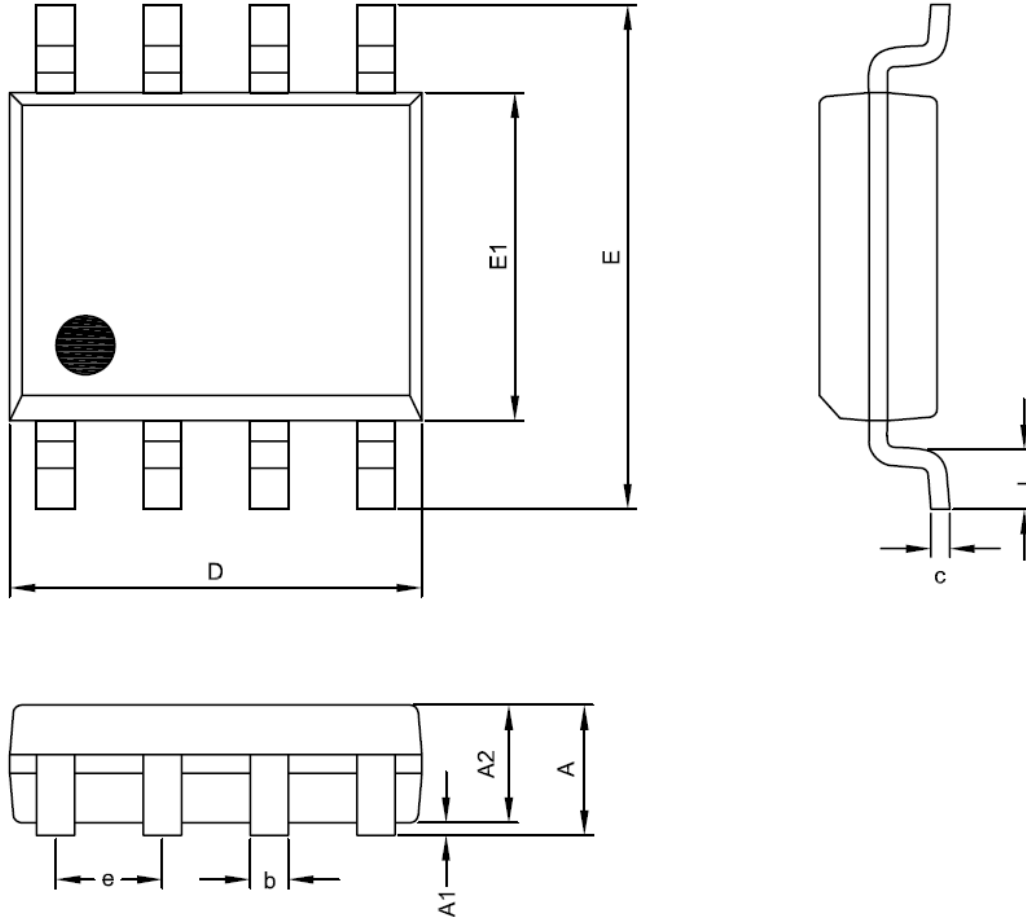
P-channel:





## 9. 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.