iM2309



N-Channel Enhancement Mode MOSFET

1. Product Information

1.1 Features

- ☑ Surface-mounted package
- ☑ Advanced trench cell design
- ☑ Extremely low threshold voltage

1.2 Applications

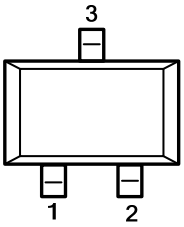
- ☑ Portable appliances

1.3 Quick reference

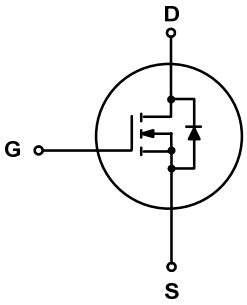
- ☑ BV ≧ 20 V
- ☑ P_{tot} ≦ 1 W
- ☑ I_D ≦ 4.4 A
- ☑ $R_{DS(ON)}$ ≦ 35 mΩ @ V_{GS} = 4.5 V
- ☑ $R_{DS(ON)}$ ≦ 48 mΩ @ V_{GS} = 2.5 V

2. Pin Description

Pin	Description	Simplified Outline	Symbol
1	Gate(G)		
2	Source(S)		
3	Drain(D)		



Top View
SOT23-3L





3. Limiting Values

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	Drain-Source Voltage	T_A = 25 ℃	-	20	V
V_{GS}	Gate-Source Voltage	T_A = 25 ℃	-	± 12	V
I_D*	Drain Current	T_A = 25 ℃, V_{GS} = 4.5 V	-	4.4	A
I_{DM}*,**	Pulsed Drain Current	T_A = 25 ℃, V_{GS} = 4.5 V	-	17.6	A
P_{tot}*	Total Power Dissipation	T_A = 25 ℃	-	1	W
T_{stg}	Storage Temperature		- 55	150	℃
T_J	Junction Temperature		-	150	℃
I_S*	Diode Forward Current	T_A = 25 ℃	-	4.4	A
E_{AS}*	Single Pulsed Avalanche Energy	V_{DD}= 20 V , L= 1.0 mH	-	12	mJ
$R_{\theta JA}$*	Thermal Resistance- Junction to Ambient		-	125	℃ / 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
iM2309	2309X X: Date Code

5. Ordering Code

iM2309 □ → Assembly Material	Assembly Material 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	20	-	-	V
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_{DS} = 250 μA	0.5	-	1	V
I_{DSS}	Drain Leakage Current	V_{DS} = 16 V, V_{GS} = 0 V	-	-	1	uA
		T_J = 85 ℃	-	-	30	μA
I_{GSS}	Gate Leakage Current	V_{GS} = ± 12 V, V_{DS} = 0 V	-	-	± 100	nA
$R_{DS(ON)}$ [a]	On-State Resistance	V_{GS} = 4.5 V, I_{DS} = 3 A	-	28	35	mΩ
		V_{GS} = 2.5 V, I_{DS} = 2 A	-	37	48	
Diode Characteristics						
V_{SD} [a]	Diode Forward Voltage	I_{SD} = 3 A, V_{GS} = 0 V	-	-	1.3	V
t_{rr}	Reverse Recovery Time	I_{SD} = 3 A, dI_{SD} / dt = 100 A / μs	-	9.4	-	nS
Q_{rr}	Reverse Recovery Charge		-	2.8	-	nC
Dynamic Characteristics [b]						
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 10 V Frequency = 1 MHz	-	278	-	pF
C_{oss}	Output Capacitance		-	52	-	
C_{rss}	Reverse Transfer Capacitance		-	46	-	
t_d(on)	Turn-on Delay Time	V_{DS} = 10 V, V_{GEN} = 4.5 V, R_G = 4.5 Ω, R_L = 3.3 Ω, I_{DS} = 3 A	-	3.9	-	nS
t_r	Turn-on Rise Time		-	28	-	
t_d(off)	Turn-off Delay Time		-	16	-	
t_f	Turn-off Fall Time		-	23	-	
Q_g	Total Gate Charge	V_{GS} = 4.5 V, V_{DS} = 10 V, I_{DS} = 3 A	-	4	-	nC
Q_{gs}	Gate-Source Charge		-	1	-	
Q_{gd}	Gate-Drain Charge		-	1.2	-	

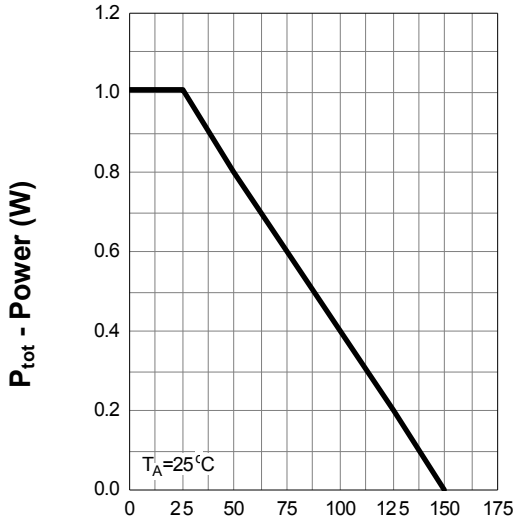
Notes :

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

b : Guaranteed by design, not subject to production testing

7. Typical Characteristics

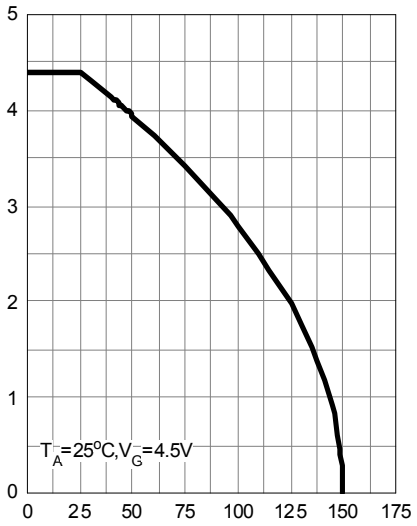
Power Dissipation



P_{tot} - Power (W)

T_j - Junction Temperature (°C)

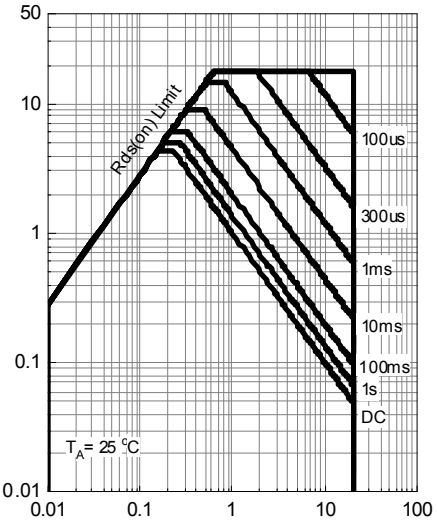
Drain Current



I_D - Drain Current (A)

T_j - Junction Temperature (°C)

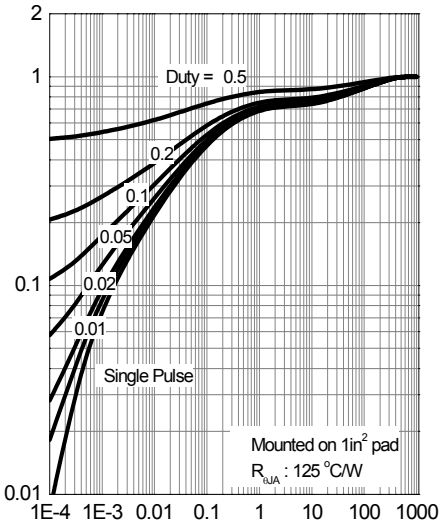
Safe Operation Area



I_D - Drain Current (A)

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

Thermal Transient Impedance

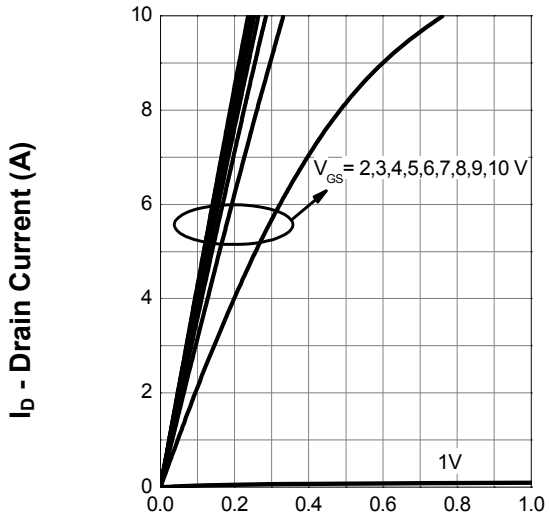


Normalized Effective Transient

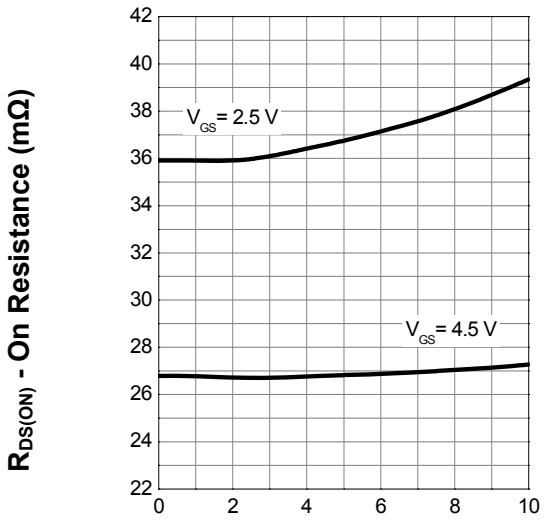
Square Wave Pulse Duration (sec)

7. Typical Characteristics (cont.)

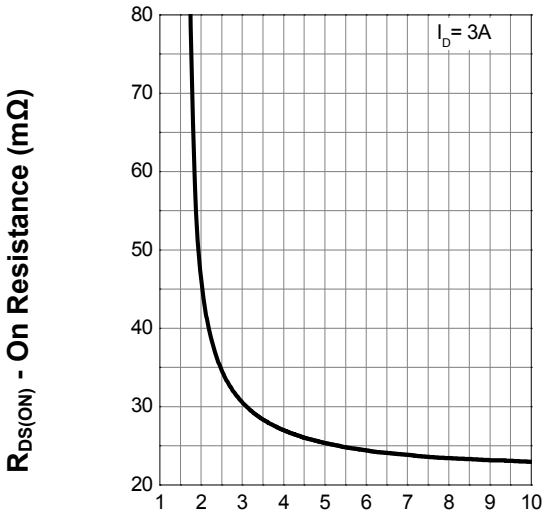
Output Characteristics



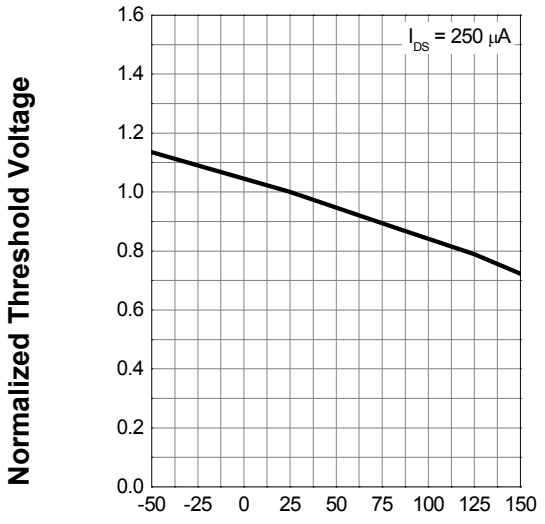
Drain-Source On Resistance



Transfer Characteristics

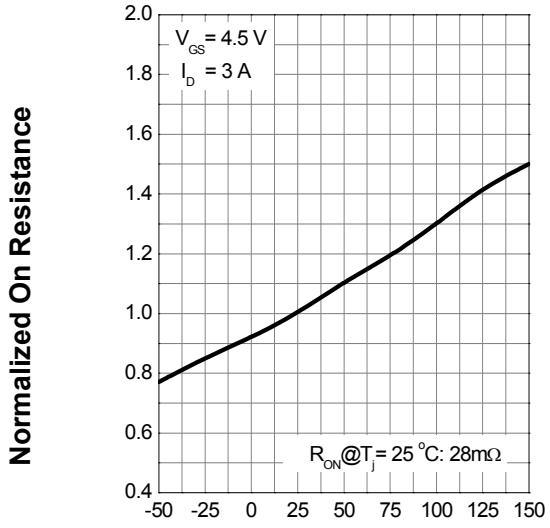


Gate Threshold Voltage

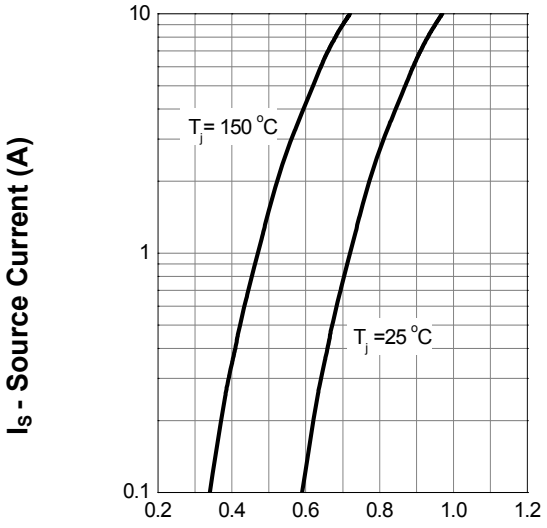


7. Typical Characteristics (cont.)

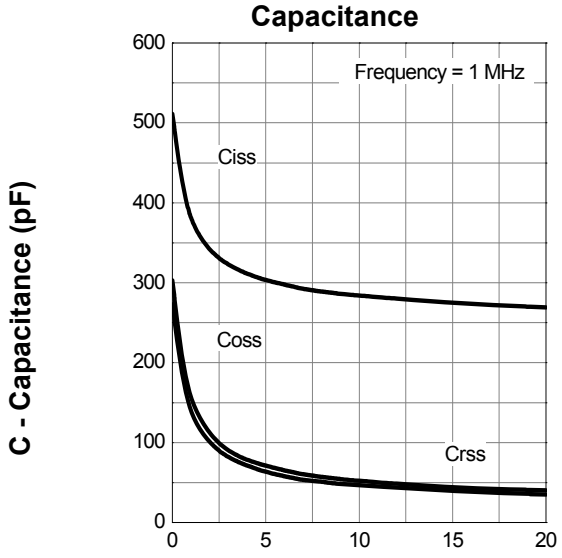
Drain-Source On Resistance



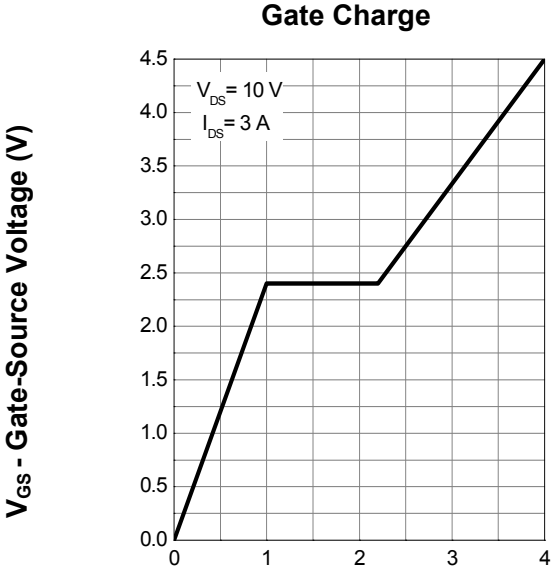
Source-Drain Diode Forward



Capacitance

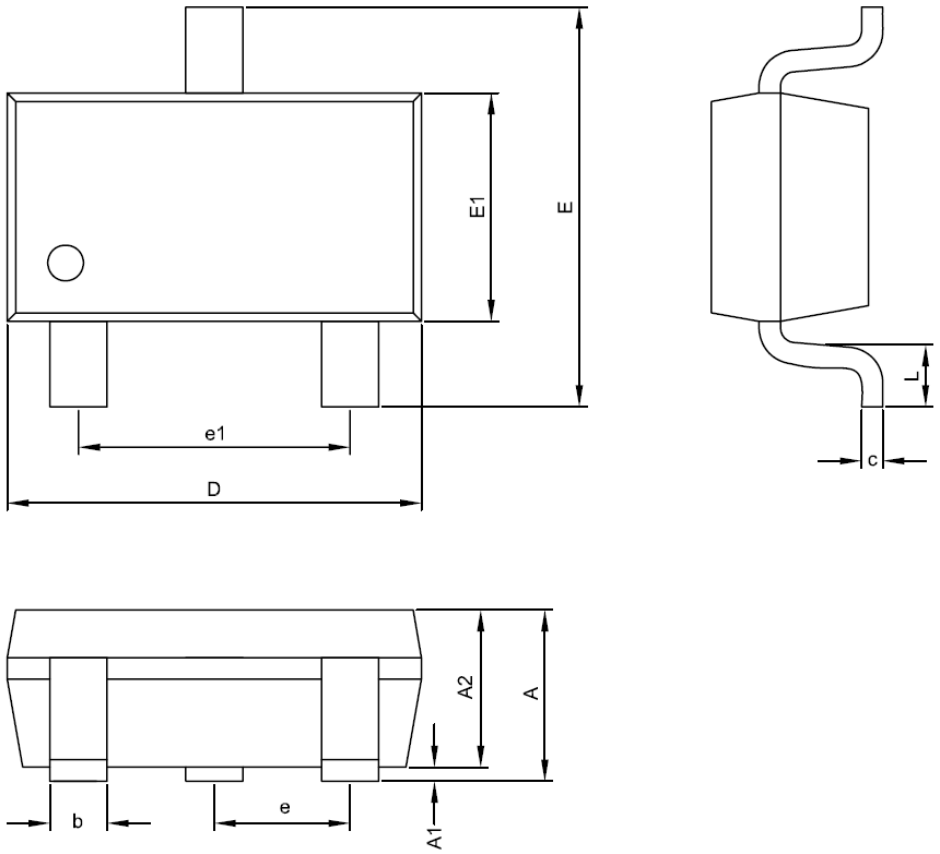


Gate Charge



8. Package Dimensions

SOT23-3L



Symbol	Dimensions In Millimeters	
	MIN.	MAX.
A	1.00	1.45
A1	0.00	0.15
A2	1.00	1.30
D	2.70	3.10
E	2.60	3.00
E1	1.50	1.70
c	0.08	0.25
b	0.30	0.50
e	0.95 BSC	
e1	1.90 BSC	
L	0.30	0.60