iM5304



Complementary Enhancement Mode MOSFET

1. Product Information

1.1 Features

- ☑ Surface-mounted package
- ☑ Low gate charge

1.2 Applications

- ☑ Motor driver appliances
- ☑ Adapter appliances
- ☑ Power management

1.3 Quick reference

N-channel

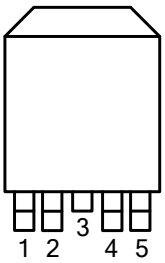
- ☑ BV ≧ 40 V
- ☑ P_{tot} ≦ 35 W
- ☑ I_D ≦ 24 A
- ☑ $R_{DS(ON)}$ ≦ 12 mΩ @ V_{GS} = 10 V
  $R_{DS(ON)}$ ≦ 17 mΩ @ V_{GS} = 4.5 V

P-channel

- ☑ BV ≦ - 40 V
- ☑ P_{tot} ≦ 35 W
- ☑ I_D ≦ - 24 A
- ☑ $R_{DS(ON)}$ ≦ 32.5 mΩ @ V_{GS} = - 10 V
  $R_{DS(ON)}$ ≦ 53 mΩ @ V_{GS} = - 4.5 V

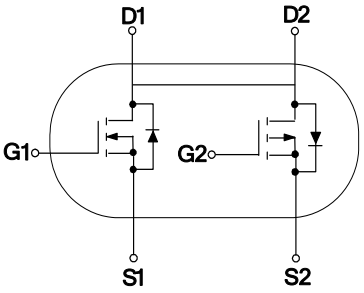
2. Pin Description

Pin	Description
1	Source (S1)
2	Gate (G1)
3	Drain (D1) / (D2)
4	Source (S2)
5	Gate (G2)



Top View

TO-252-4L





3. Limiting Values

Symbol	Parameter	Conditions	Min	Max	Unit
N-channel					
V_{DS}	Drain-Source Voltage	T_C = 25 ℃	40	-	V
V_{GS}	Gate-Source Voltage	T_C = 25 ℃	-	± 20	V
I_D*,***	Drain Current	T_C = 25 ℃, V_{GS} = 10 V	-	24	A
		T_C = 100 ℃, V_{GS} = 10 V	-	24	A
I_{DM}*,**,***	Pulsed Drain Current	T_C = 25 ℃, V_{GS} = 10 V	-	48	A
E_{AS}*	Single Pulsed Avalanche Energy	V_{DD}= 40 V , L= 1 mH	-	91	mJ
P-channel					
V_{DS}	Drain-Source Voltage	T_C = 25 ℃	- 40	-	V
V_{GS}	Gate-Source Voltage	T_C = 25 ℃	-	± 20	V
I_D*,***	Drain Current	T_C = 25 ℃, V_{GS} = - 10 V	-	- 24	A
I_D*		T_C = 100 ℃, V_{GS} = - 10 V	-	- 13	A
I_{DM}*,**,***	Pulsed Drain Current	T_C = 25 ℃, V_{GS} = - 10 V	-	- 48	A
E_{AS}*	Single Pulsed Avalanche Energy	V_{DD}= - 40 V , L= 1 mH	-	120	mJ
P_{tot}	Total Power Dissipation	T_C = 25 ℃	-	35	W
T_{stg}	Storage Temperature		- 55	150	℃
T_J	Junction Temperature		- 55	150	℃
$R_{\theta JC}$*	Thermal Resistance- Junction to Case		-	3.5	℃ / W
$R_{\theta JA}$*	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 %

*** limited by bonding wire

4.Marking Information

Product Name	Marking
iM5304	iM5304 XXXXX X : Date Code

5. Ordering Code

iM5304 □ → 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)

N-channel:

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_{DS} = 250 μA	40	-	-	V
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_{DS} = 250 μA	1	-	2	V
I_{DSS}	Drain Leakage Current	V_{DS} = 32 V, V_{GS} = 0 V	-	-	1	uA
I_{GSS}	Gate Leakage Current	V_{GS} = ± 20 V, V_{DS} = 0 V	-	-	± 100	nA
$R_{DS(ON)}$[a]	Channel On-State Resistance	V_{GS} = 10 V, I_D = 20 A	-	9.5	12	mΩ
		V_{GS} = 4.5 V, I_D = 10 A	-	13	17	
Diode Characteristics						
V_{SD}[a]	Diode Forward Voltage	I_{SD} = 20 A, V_{GS} = 0 V	-	-	1.3	V
t_{rr}	Reverse Recovery Time	I_{SD} = 20 A, dI_{SD} / dt = 100 A / μs	-	6.4	-	nS
Q_{rr}	Reverse Recovery Charge		-	1.9	-	nC
Dynamic Characteristics[b]						
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 20 V Frequency = 1 MHz	-	1609	-	pF
C_{oss}	Output Capacitance		-	112	-	
C_{rss}	Reverse Transfer Capacitance		-	87	-	
t_d(on)	Turn-on Delay Time	V_{DS} = 20 V, V_{GEN} = 10 V, R_G = 3.9 Ω, R_L = 1 Ω, I_{DS} = 20 A	-	6.1	-	nS
t_r	Turn-on Rise Time		-	43	-	
t_d(off)	Turn-off Delay Time		-	34	-	
t_f	Turn-off Fall Time		-	31	-	
Gate Charge Characteristics[b]						
Q_g	Total Gate Charge	V_{GS} = 10 V, V_{DS} = 20 V, I_{DS} = 20 A	-	31	-	nC
Q_{gs}	Gate-Source Charge		-	7	-	
Q_{gd}	Gate-Drain Charge		-	4.7	-	

Notes :

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

b : Guaranteed by design, not subject to production testing



7. Electrical Characteristics (T_A = 25 °C Unless Otherwise Noted)

P-channel :

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_{DS} = - 250 µA	- 40	-	-	V
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_{DS} = - 250 µA	- 1	-	- 2	V
I_{DSS}	Drain Leakage Current	V_{DS} = - 32 V, V_{GS} = 0 V	-	-	- 1	uA
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} = - 10 A	-	26	32.5	mΩ
		V_{GS} = - 4.5 V, I_{DS} = - 5 A	-	41	53	
Diode Characteristics						
V_{SD}[a]	Diode Forward Voltage	I_{SD} = - 10 A, V_{GS} = 0 V	-	-	- 1.3	V
t_{rr}	Reverse Recovery Time	I_{SD} = - 10 A, dI_{SD}/dt = 100 A/µs	-	13	-	nS
Q_{rr}	Revers Recovery Charge		-	9.1	-	nC
Dynamic Characteristics[b]						
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = - 20 V Frequency = 1 MHz	-	1764	-	pF
C_{oss}	Output Capacitance		-	113	-	
C_{rss}	Reverse Transfer Capacitance		-	81	-	
t_d(on)	Turn-on Delay Time	V_{DS} = - 20 V, V_{GEN} = -10 V, R_G = 3.9 Ω, RL = 2 Ω, I_{DS} = - 10 A	-	18	-	nS
t_r	Turn-on Rise Time		-	55	-	
t_d(off)	Turn-off Delay Time		-	214	-	
t_f	Turn-off Fall Time		-	104	-	
Gate Charge Characteristics[b]						
Q_g	Total Gate Charge	V_{GS} = -10 V, V_{DS} = - 20 V, I_{DS} = - 10 A	-	28	-	nC
Q_{gs}	Gate-Source Charge		-	8.6	-	
Q_{gd}	Gate-Drain Charge		-	3.5	-	

Notes :

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

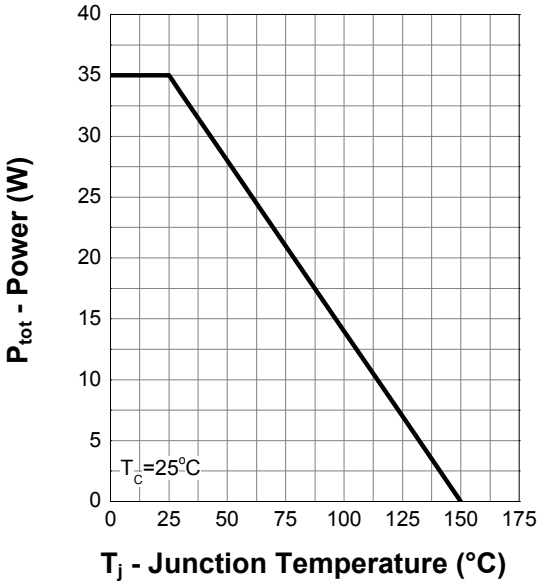
b : Guaranteed by design, not subject to production testing



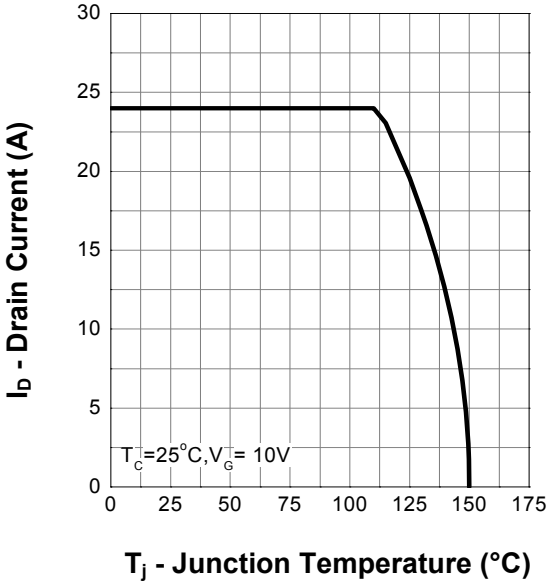
8. Typical Characteristics

N-channel:

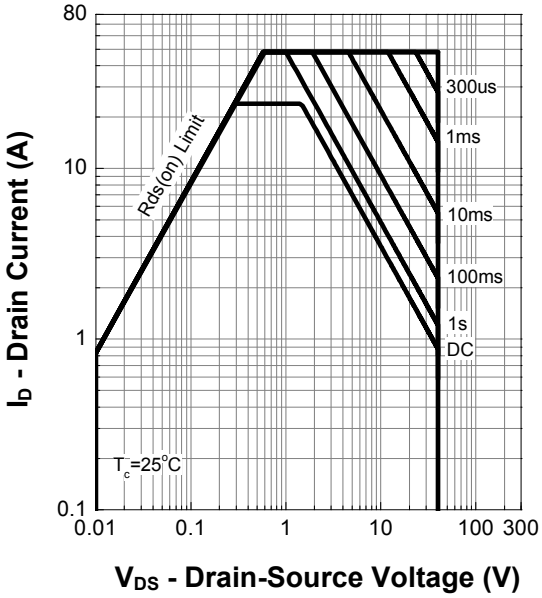
Power Capability



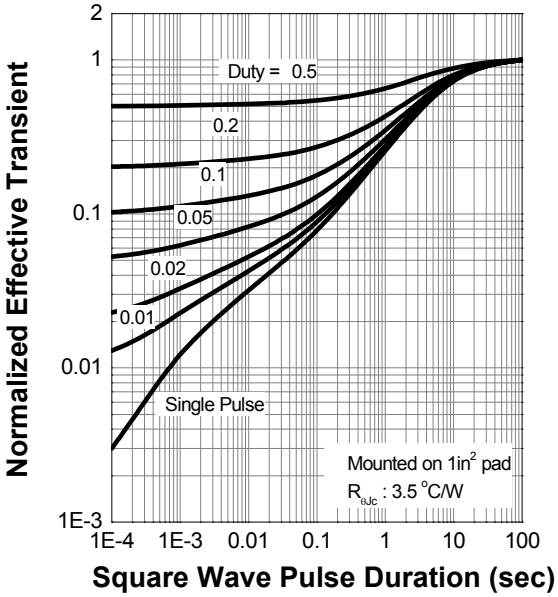
Current Capability



Safe Operation Area



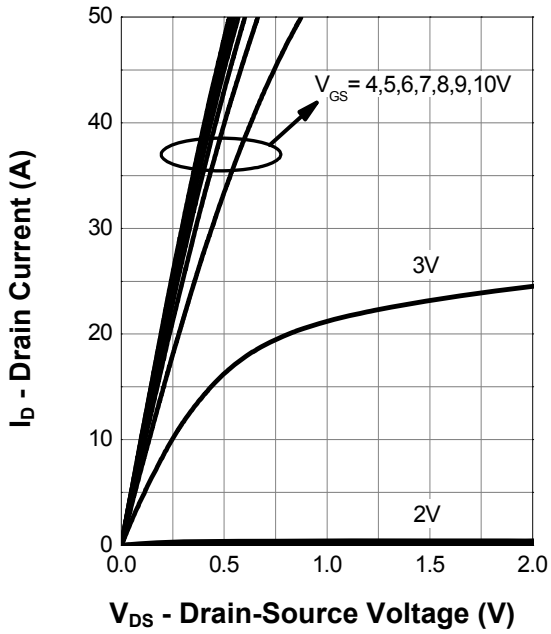
Thermal Transient Impedance



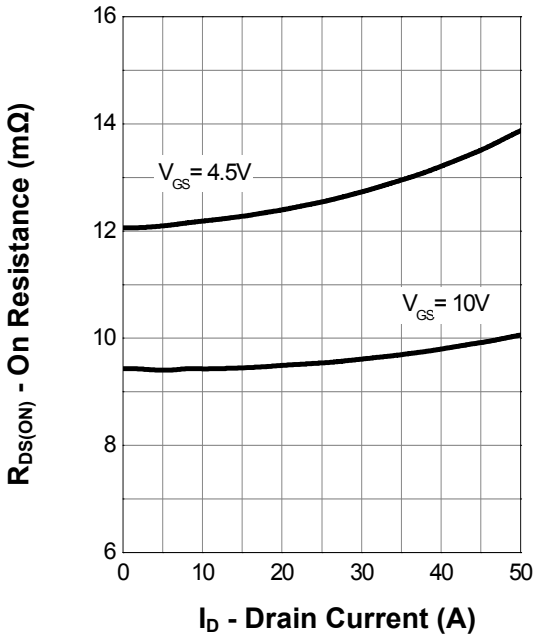
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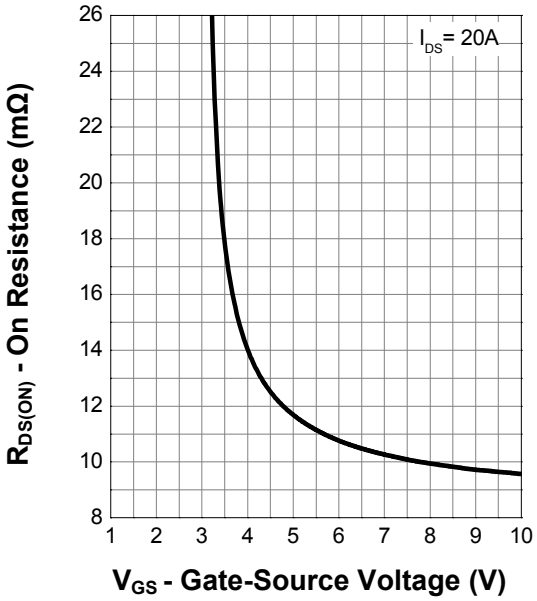
Output Characteristics



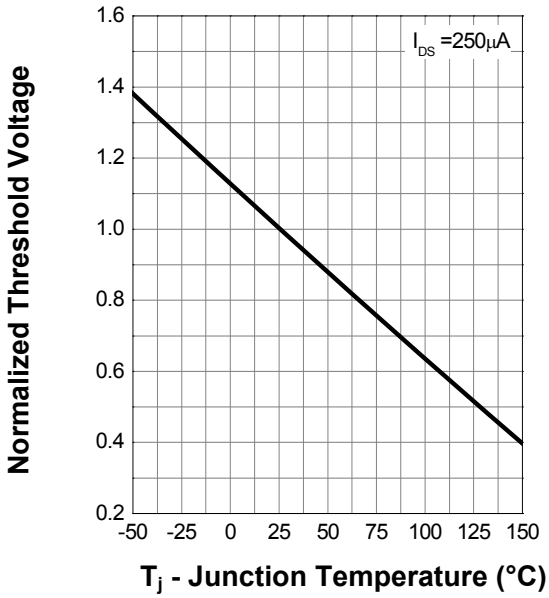
On Resistance



Transfer Characteristics



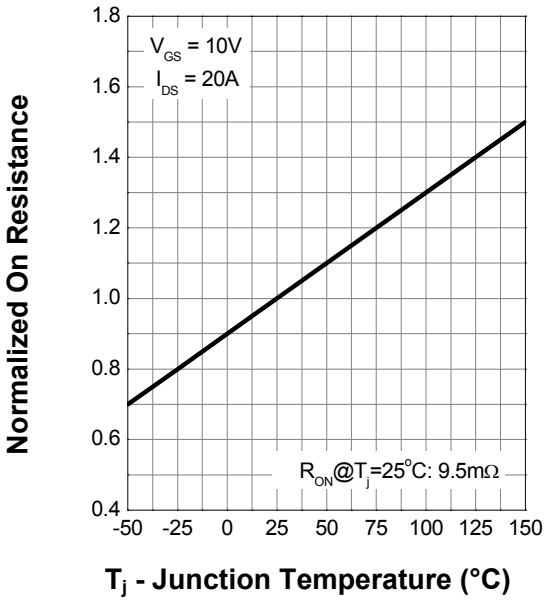
Normalized Threshold Voltage



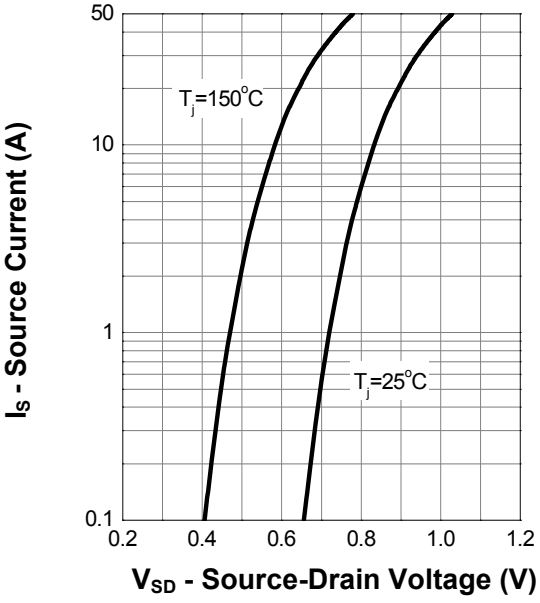
8. Typical Characteristics (cont.)

N-channel:

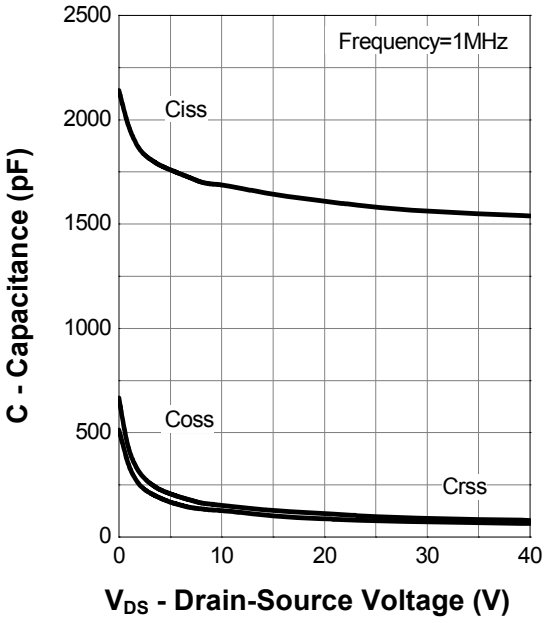
Normalized On Resistance



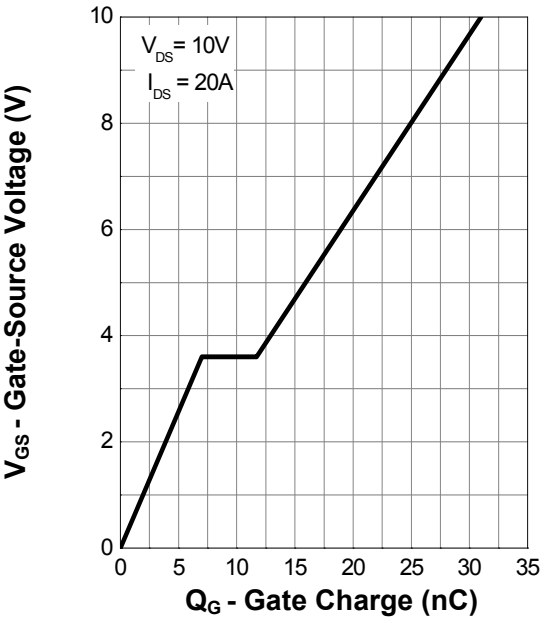
Diode Forward Current



Capacitance



Gate Charge

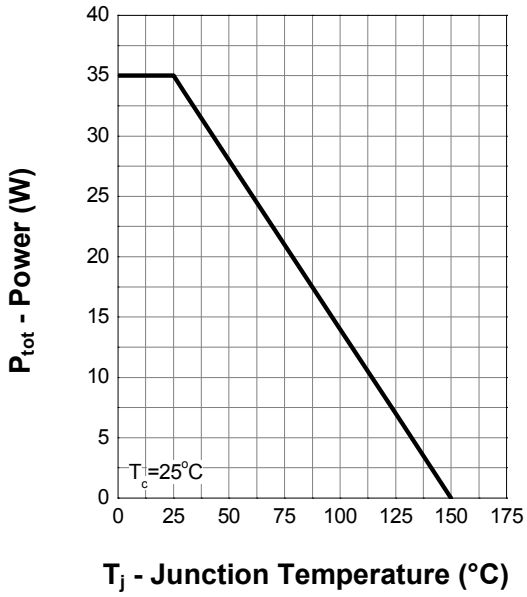




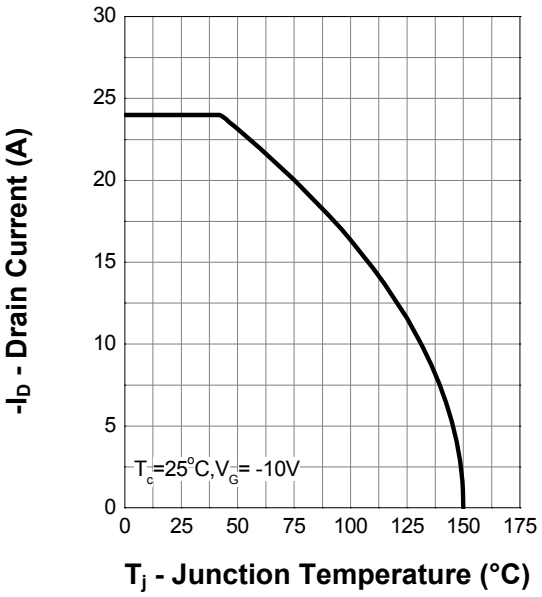
9. Typical Characteristics

P-channel:

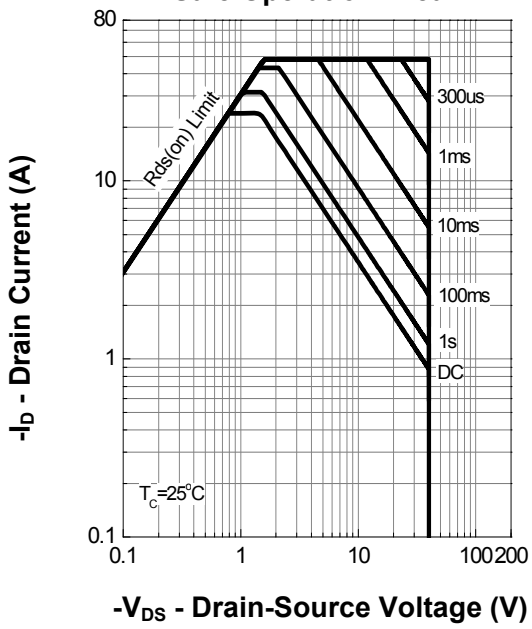
Power Capability



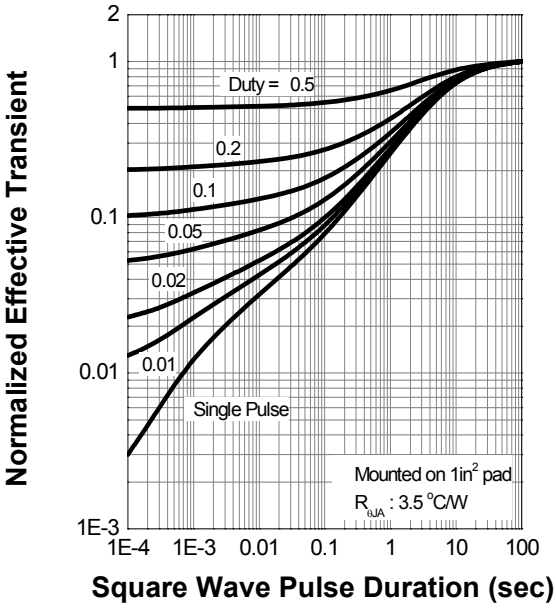
Current Capability



Safe Operation Area



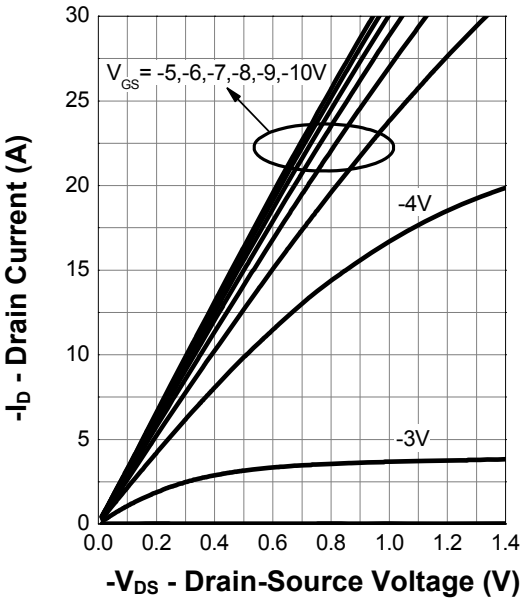
Thermal Transient Impedance



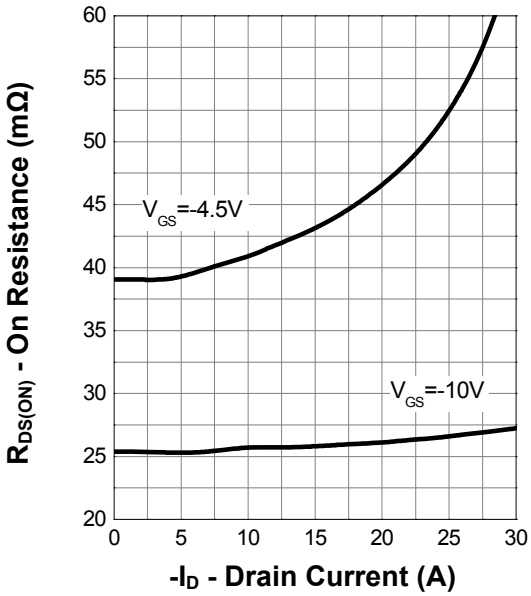
9. Typical Characteristics (cont.)

P-channel:

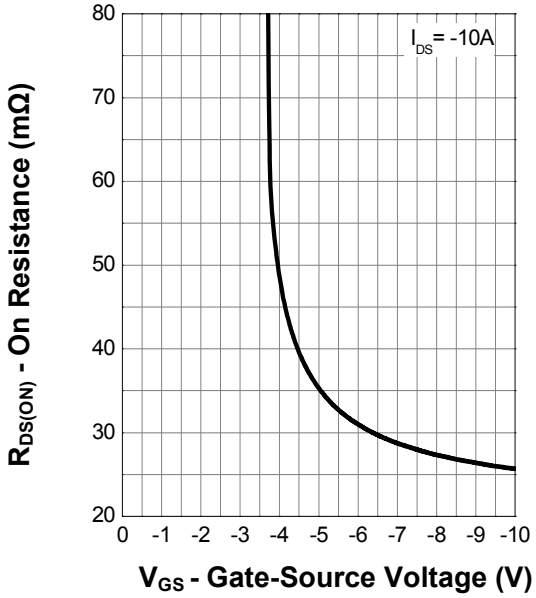
Output Characteristics



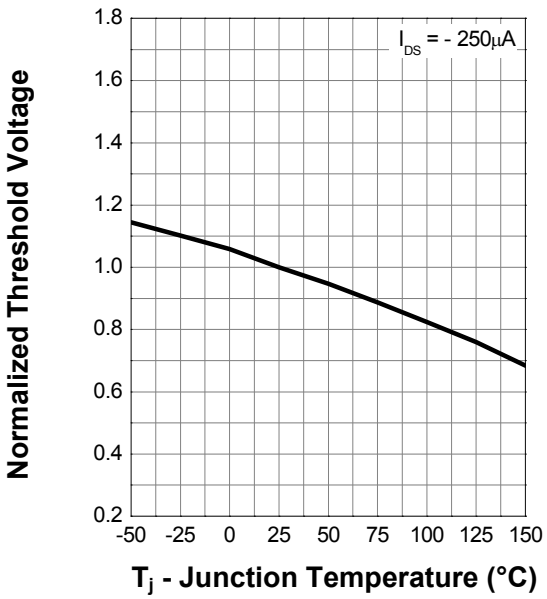
On Resistance



Transfer Characteristics



Normalized Threshold Voltage

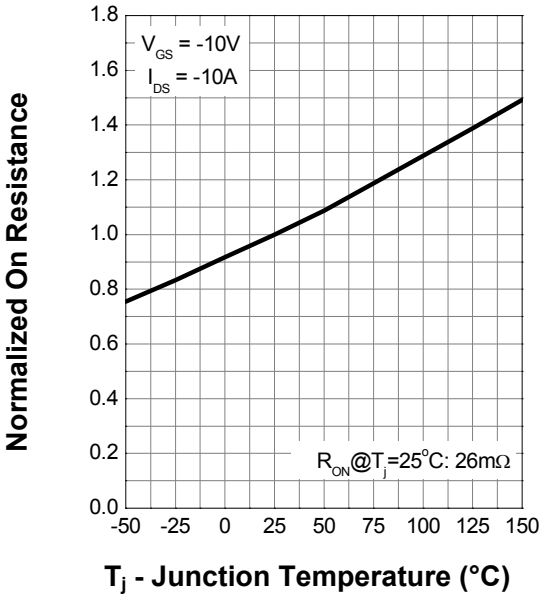




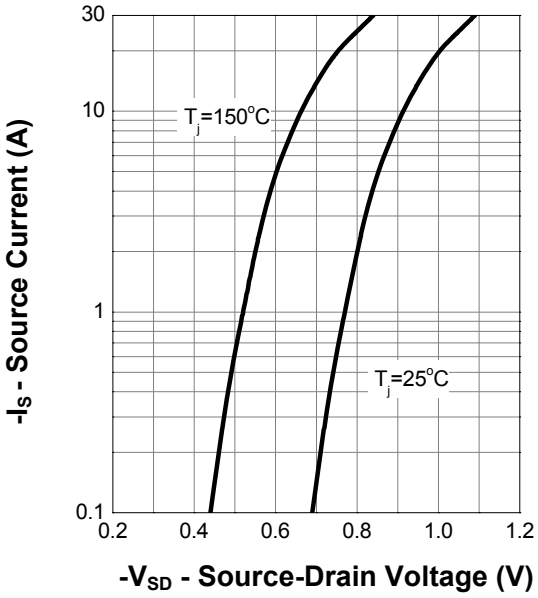
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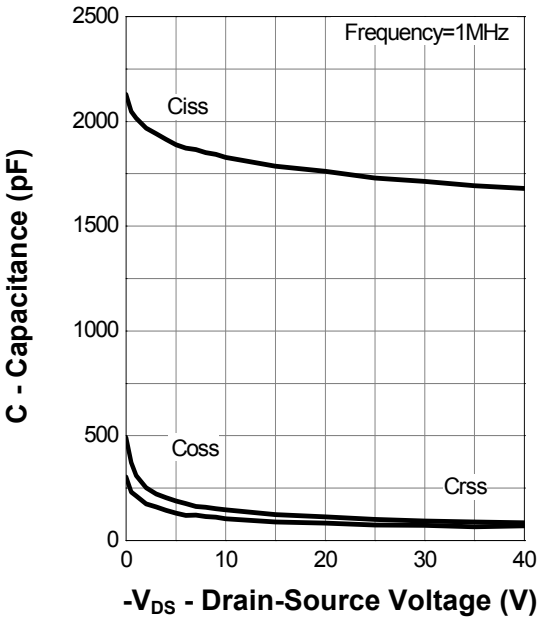
Normalized On Resistance



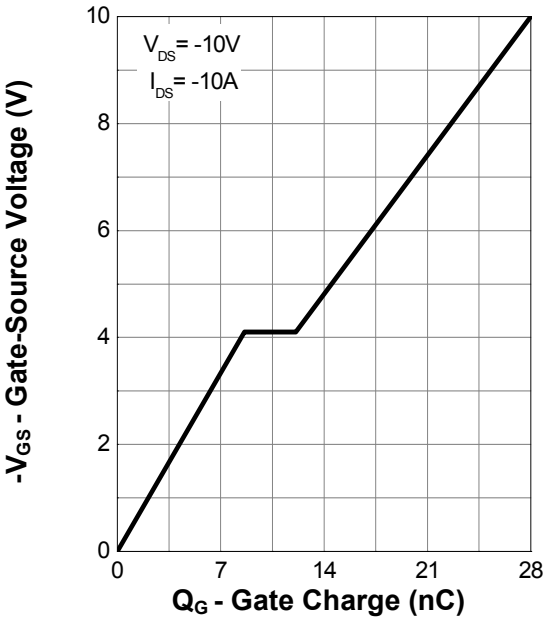
Diode Forward Current



Capacitance

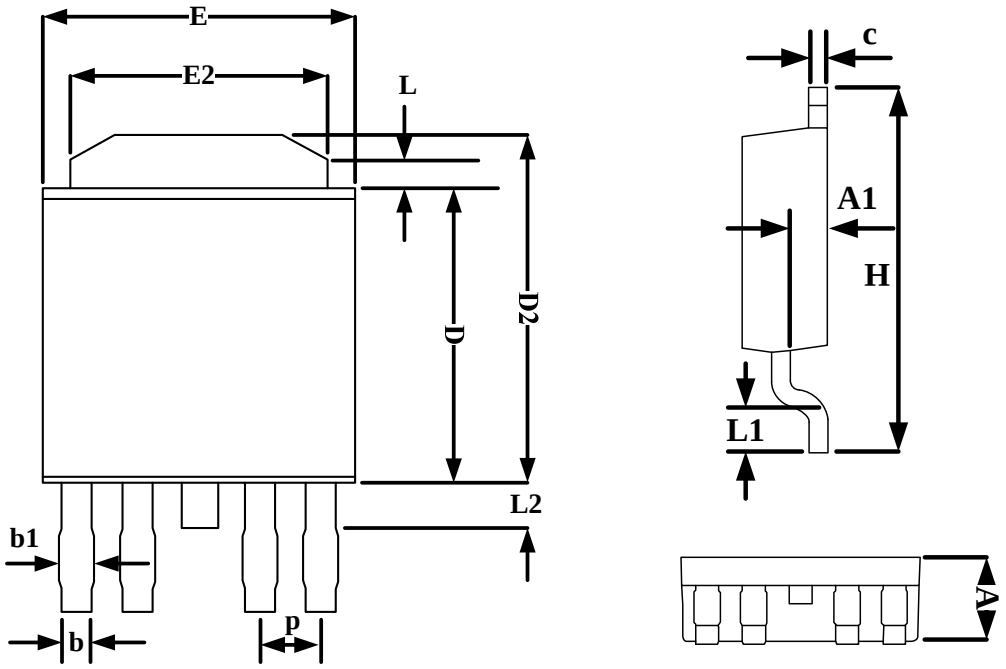


Gate Charge



10. Package Dimensions

TO-252-4L



Symbol	Dimensions In Millimeters	
	MIN.	MAX.
A	2.22	2.38
A1	0.95	1.05
C	0.49	0.53
E	6.4	6.60
E2	5.23	5.43
D	6.00	6.20
D2	7.05	7.35
H	9.60	10.2
L	0.6	Ref
L1	1.4	1.65
L2	0.65	0.95
b	0.55	0.65
b1	0.64	0.84
P	1.27	BSC