

N-Channel Enhancement Mode MOSFET

1. Product Information

1.1 Features

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

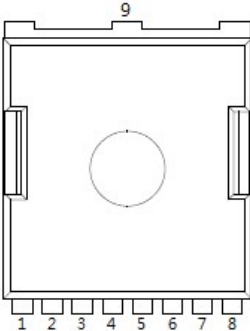
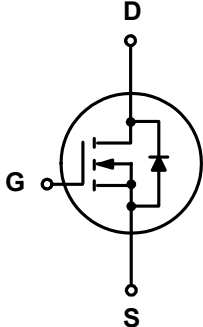
1.2 Applications

- ☒ LCD TV appliances
- ☒ LCDM appliances
- ☒ High power inverter system

1.3 Quick reference

- ☒ $BV \geq 40V$
- ☒ $P_{tot} \leq 300W$
- ☒ $I_D \leq 300A$
- ☒ $R_{DS(ON)} \leq 0.53 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$
- ☒ $R_{DS(ON)} \leq 0.95 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$

2. Pin Description

Pin	Description	Simplified Outline	Symbol
1	Gate(G)	 Top View TOLL	
2,3,4,5,6,7,8	Source(S)		
9	Drain(D)		

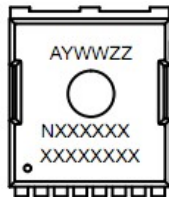
3. Limiting Values

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	Drain-Source Voltage	$T_C = 25\text{ }^{\circ}\text{C}$	-	40	V
V_{GS}	Gate-Source Voltage	$T_C = 25\text{ }^{\circ}\text{C}$	-	± 20	V
$I_{D^{*},***}$	Drain Current (DC)	$T_C = 25\text{ }^{\circ}\text{C}, V_{GS} = 10\text{ V}$	-	300	A
		$T_C = 100\text{ }^{\circ}\text{C}, V_{GS} = 10\text{ V}$	-	300	A
I_{DM}^{*}	Drain Current (Pulsed)	$T_C = 25\text{ }^{\circ}\text{C}, V_{GS} = 10\text{ V}$	-	1200	A
P_{tot}	Drain power dissipation	$T_C = 25\text{ }^{\circ}\text{C}$	-	300	W
T_{stg}	Storage Temperature		-55	175	$^{\circ}\text{C}$
T_J	Junction Temperature		-	175	$^{\circ}\text{C}$
I_S	Continuous-Source Current	$T_C = 25\text{ }^{\circ}\text{C}$	-	300	A
E_{AS}	Single Pulsed Avalanche Energy	$V_{DD}=40\text{ V}, L=1.0\text{ mH}$	-	3042	mJ
$R_{\theta JA}^{**}$	Thermal Resistance- Junction to Ambient		-	44	$^{\circ}\text{C/W}$
$R_{\theta JC}^{**}$	Thermal Resistance- Junction to Case		-	0.5	

Notes :

- * Pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$
- ** Surface Mounted on 1 in^2 pad area, $t \leq 10\text{ sec}$
- *** Limited by bonding wire

4. Marking Information

Product Name	Marking
UP40T209TL	

5. Ordering Code

Product Name	Package	Reel Size	Tape width	Quantity	Note
UP40T209TL	TOLL-8L			2000	

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	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	μA
I _{GSS}	Gate Leakage Current	V _{GS} = 0 V, V _{GS} = ± 20 V	-	-	±100	nA
R _{DS(ON)} ^a	On-State Resistance	V _{GS} = 10 V, I _{DS} = 50 A	-	0.45	0.53	m Ω
		V _{GS} = 4.5 V, I _{DS} = 30 A	-	0.75	0.95	
Diode Characteristics						
V _{SD} ^a	Diode Forward Voltage	I _{SD} = 50 A, V _{GS} = 0 V	-	-	1.3	V
t _{rr}	Reverse Recovery Time	I _{DS} = 50 A, V _{GS} = 0 V di _{SD} /dt = 100 A/μs	-	42	-	nS
Q _{rr}	Reverse Recovery Charge		-	43	-	nC
Dynamic Characteristics ^b						
C _{iss}	Input Capacitance	V _{GS} = 0 V, V _{DS} = 20 V Frequency = 1 MHz	-	32824	-	pF
C _{oss}	Output Capacitance		-	2465	-	
C _{rss}	Reverse Transfer Capacitance		-	1995	-	
t _{d(on)}	Turn-on Delay Time	V _{DS} = 20 V, V _{GEN} = 10 V, R _G = 3.9 Ω, R _L = 0.4 Ω, I _{DS} = 50 A	-	35	-	nS
t _r	Turn-on Rise Time		-	141	-	
t _{d(off)}	Turn-off Delay Time		-	500	-	
t _f	Turn-off Fall Time		-	243	-	
Gate Charge Characteristics ^b						
Q _g	Total Gate Charge	V _{DS} = 20 V, V _{GS} = 10 V, I _{DS} = 50 A	-	602	-	nC
Q _{gs}	Gate-Source Charge		-	131	-	
Q _{gd}	Gate-Drain Charge		-	83	-	

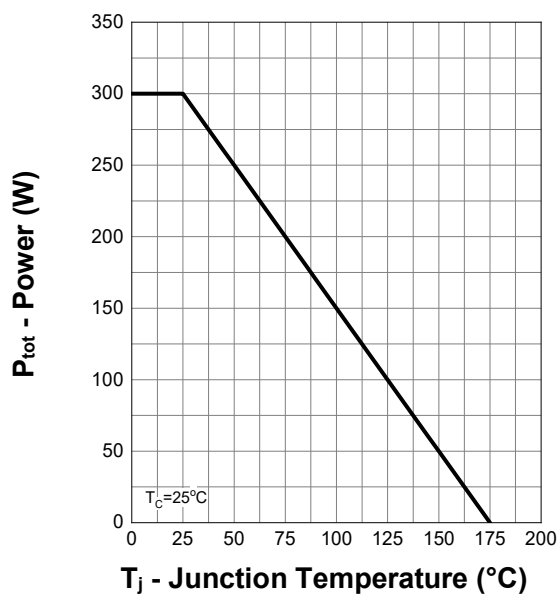
Notes :

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

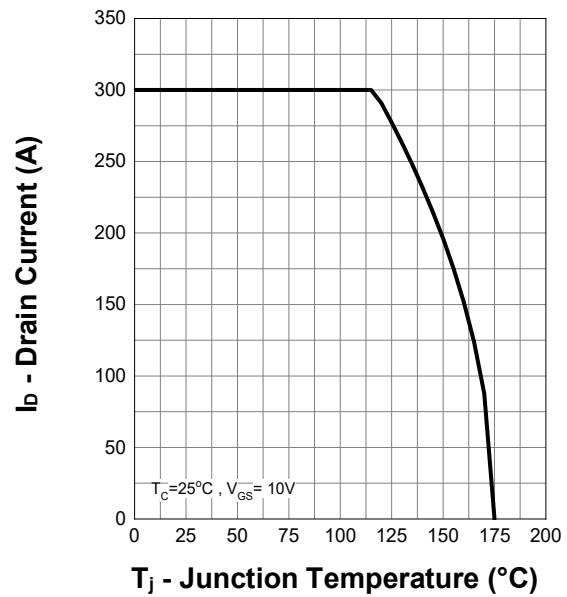
b : Guaranteed by design, not subject to production testing

7. Typical Characteristics

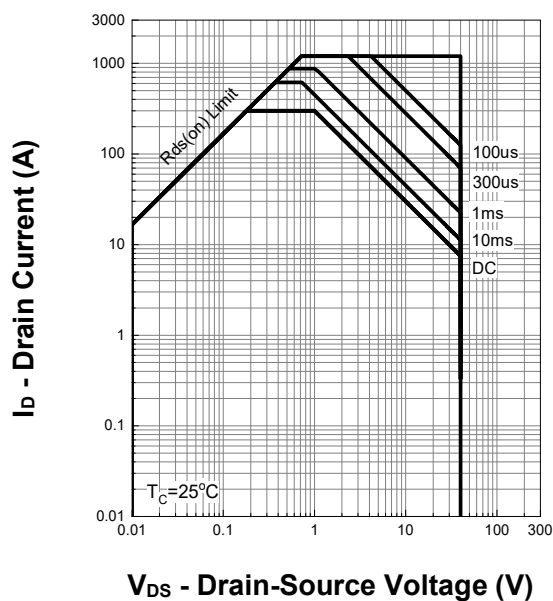
Power Capability



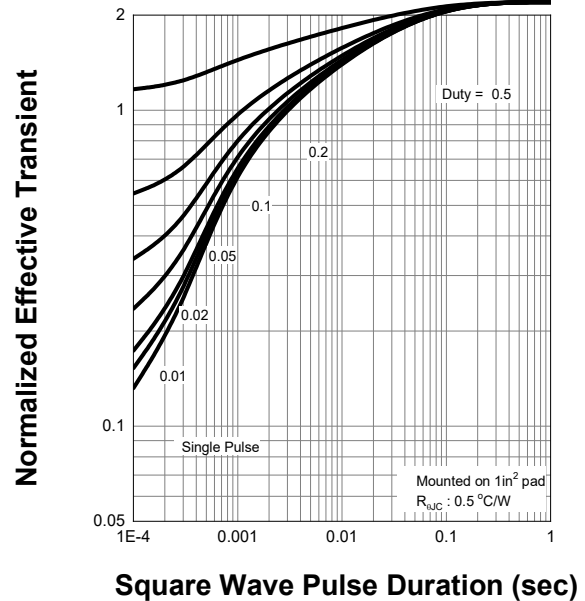
Current Capability



Safe Operating Area

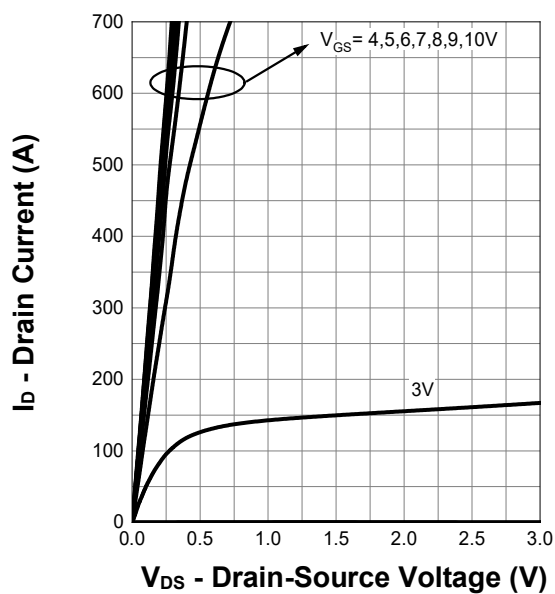


Transient Thermal Impedance

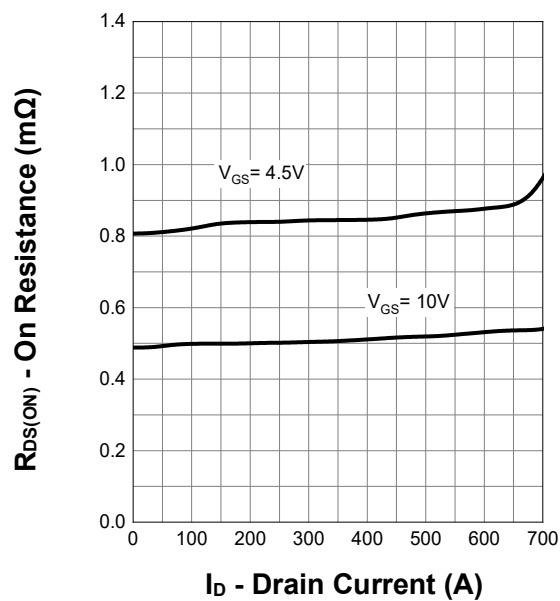


7. Typical Characteristics (cont.)

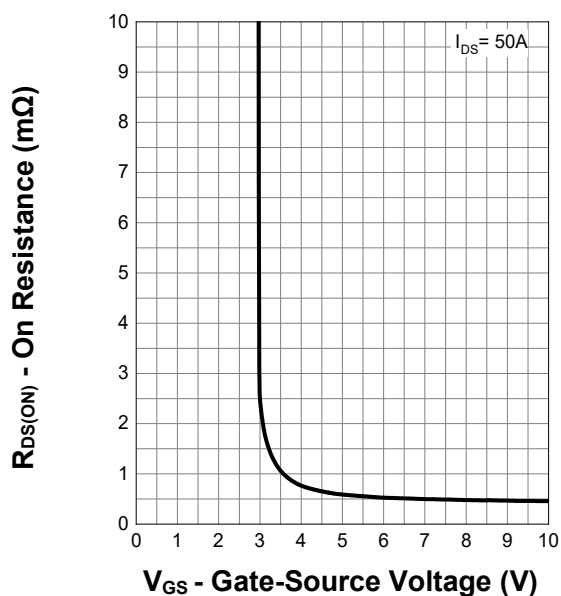
Output Characteristics



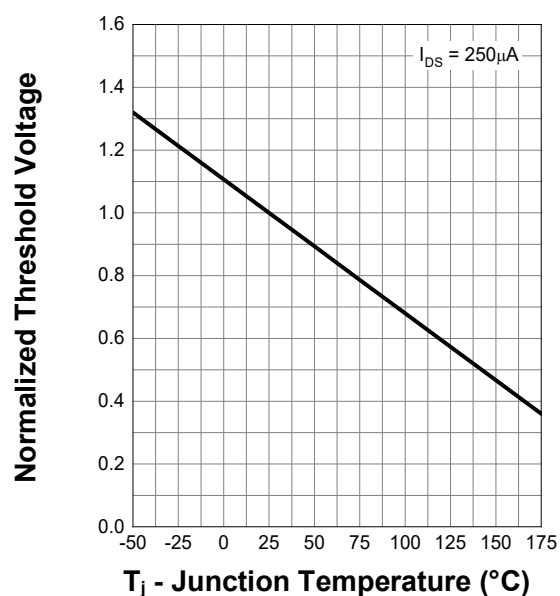
On Resistance



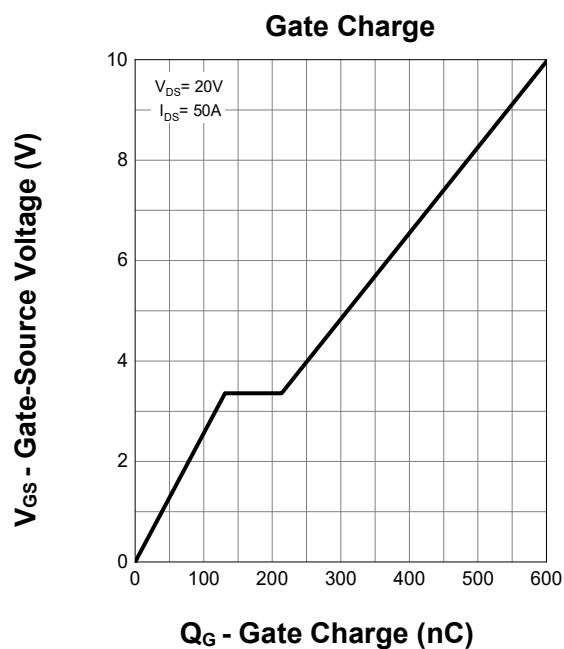
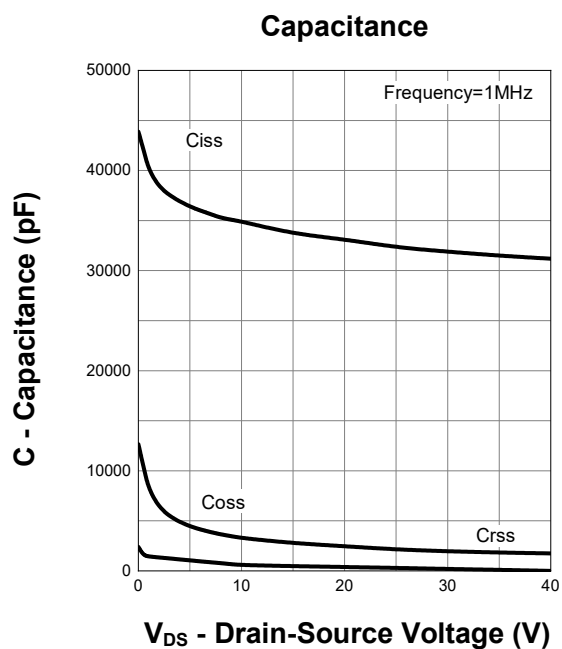
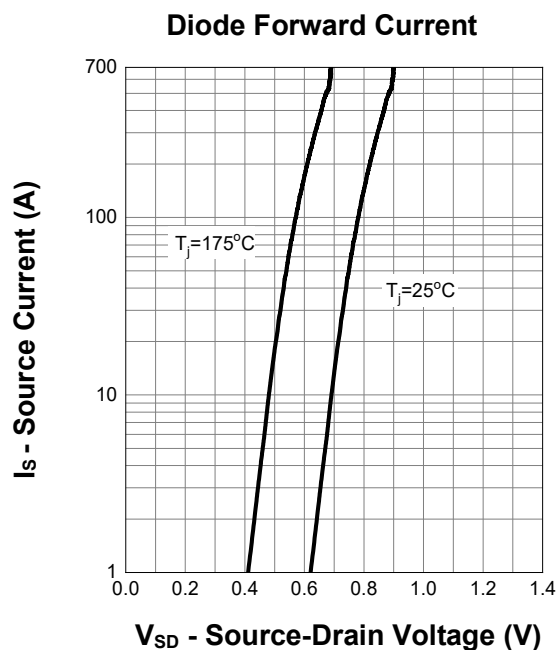
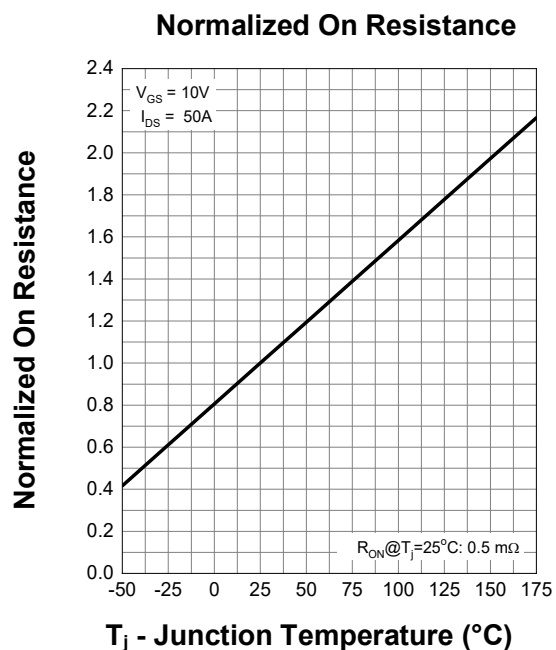
Transfer Characteristics



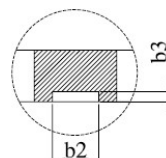
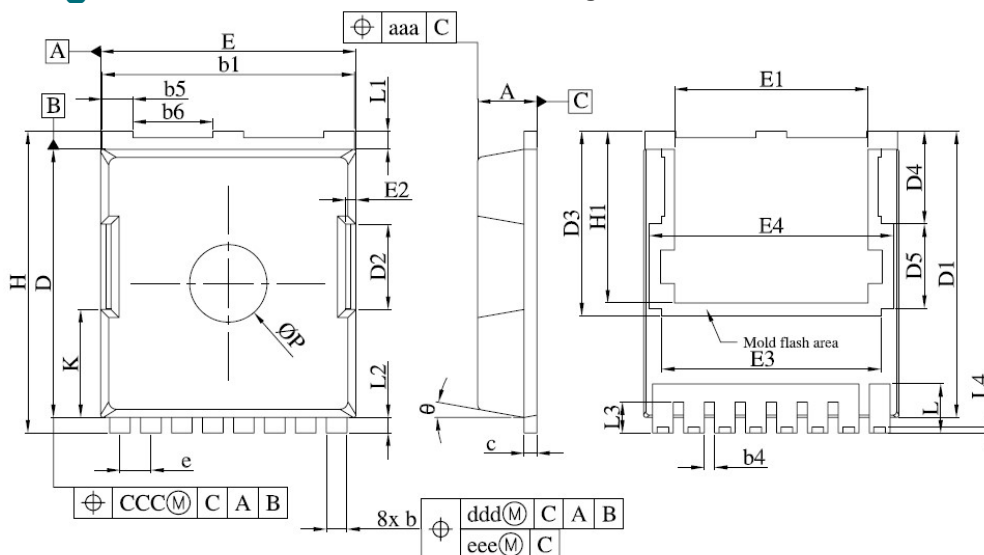
Normalized Threshold Voltage



7. Typical Characteristics (cont.)



8. Package Dimensions TOLL-8L Package



Symbol	Dimensions In Millimeters	
	MIN.	MAX.
A	2.20	2.40
b	0.70	0.90
b1	9.70	9.90
b2	0.36	0.55
b3	0.05	/
b4	0.30	0.50
b5	1.10	1.30
b6	3.00	3.20
c	0.40	0.60
D	10.28	10.55
D1	10.98	11.18
D2	3.20	3.40
D3	7.15	
D4	3.59	
D5	3.26	
e	1.10	1.30
E	9.80	10.00
E1	7.40	7.60

Symbol	Dimensions In Millimeters	
	MIN.	MAX.
E2	7.40	7.60
E3	8.50	
E4	9.46	
H	11.50	11.85
H1	6.55	6.75
K	4.08	4.28
L	1.60	2.10
L1	0.50	0.90
L2	0.50	0.70
L3	1.00	1.30
L4	0.13	0.33
P	2.85	3.15
θ	10°REF	
aaa	0.20	
ccc	0.20	
ddd	0.25	
eee	0.20	