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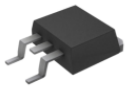
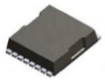
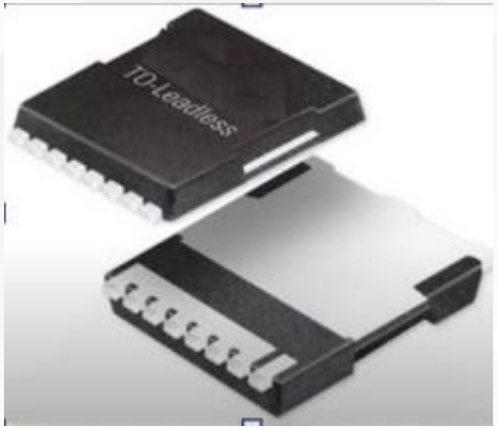
Introduction to Package TOLL-8L

Contents

一、 Project Introduction
1.1 Product Features

TOLL(TO Lead Less) become a popular package for power semiconductor devices due to its excellent electrical performance, thermal performance, small size, and high reliability

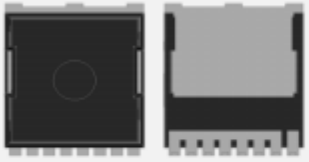
	D^2PAK	D^2PAK 7pin	TO-LeadLess
			
Power Density	★★	★★★	★★★★
Current Capability	★★	★★★	★★★★
Thermal Performance	★	★★	★★★
Height	★	★	★★★
Reliability	★★★	★★★	★★★★

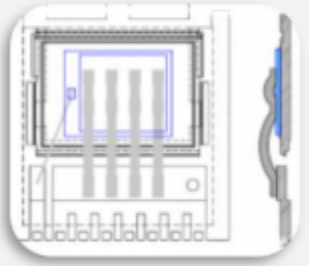


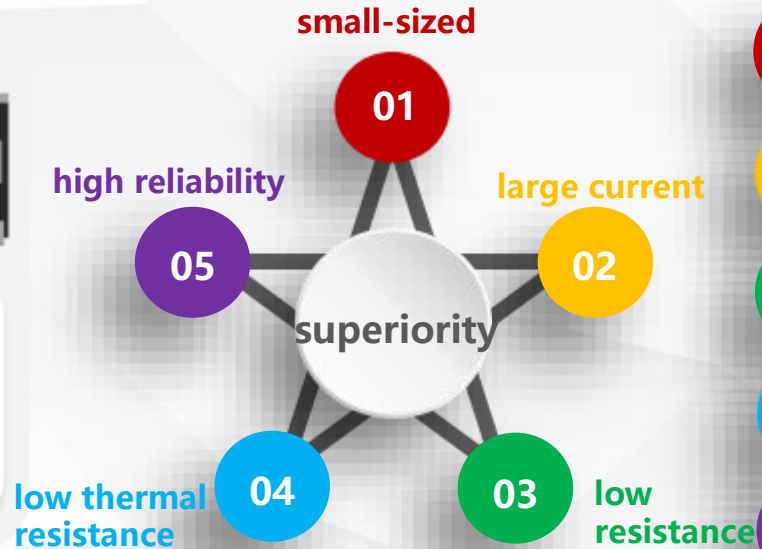
The rapid development of new energy products (EV, energy storage, and supporting applications), high-power supplies, and motors has further improved the requirements for product energy efficiency. MOSFET need to withstand transient high energy flow and achieve the highest heat dissipation rate and the lowest thermal resistance within a limited physical heat dissipation limit of the material. Under this limit, the ultra-low conduction impedance and parasitic inductance, as well as better EMI performance and thermal performance of TOLL packages, just meet the requirements of this development trend. Secondly, the actual circuit design and application of TOLL packages require fewer parallel and heat dissipation components, which can save PCB space, Thereby improving overall reliability.

1.2 TOLL MOSFET Advantages

Aluminum wire bonding







01 Small size
Compared to D2PAK, size decreases by 60%

02 Large current carrying capacity
TOLL current carrying capacity up to 300A

03 Low conduction resistance
Compared to D2PAK, the interconnection conduction resistance decreases by 30%

04 Low thermal resistance
Compared to D2PAK, the thermal resistance of the product decreases by 20%

05 High board level reliability
Compared to D2PAK, the welding area of the pin increases by 55.6%

1.2 TOLL MOSFET Advantages

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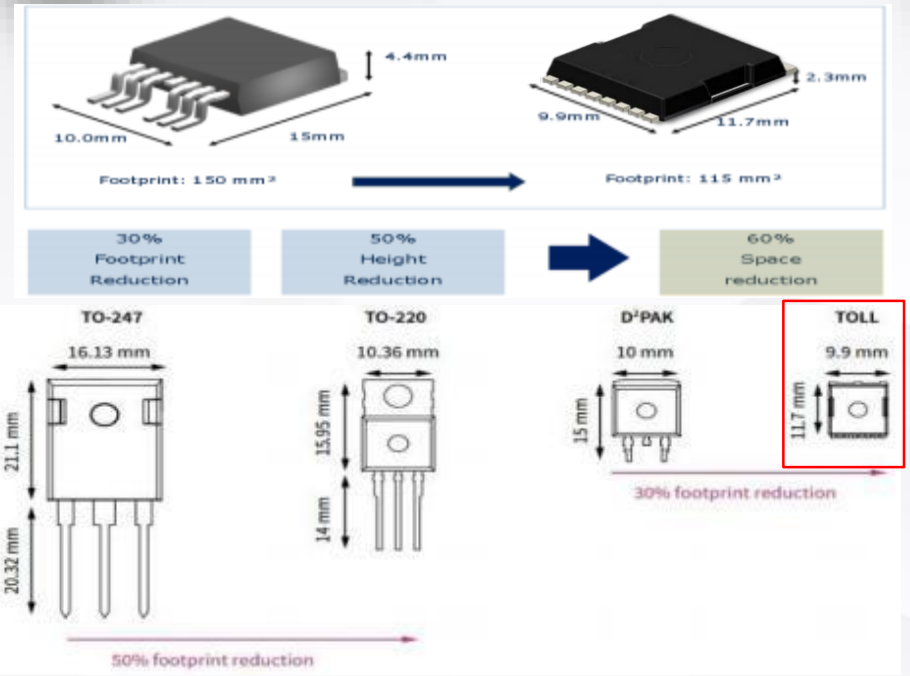
01 Small device size

Compared to D2PAK, size decreases by 60%



02 Large device current carrying capacity

TOLL current carrying capacity up to 300A

		D²PAK	D²PAK 7pin	TOLL
lowest $R_{DS(on)}$	30V	3.4 mΩ	0.9 mΩ	0.4 mΩ
	60V	1.9 mΩ	1.0 mΩ	0.75 mΩ
	100V	2.7 mΩ	2.5 mΩ	2.0 mΩ
	150V	7.2 mΩ	6.5 mΩ	5.9 mΩ
Package Resistance		0.74 mΩ	0.44 mΩ	0.25 mΩ
Current Capability		120A	180 A	300 A
Footprint		150 mm²	150 mm²	115 mm²
Inductivity		5 nH	5 nH	1-2 nH

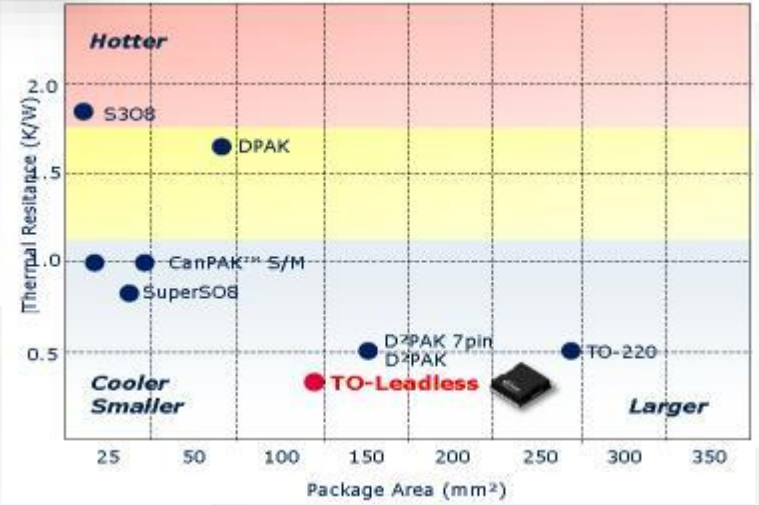
1.2 TOLL MOSFET Advantages

03 Low device conduction resistance

Compared to D2PAK, the interconnection conduction resistance decreases by 30%

04 Low device thermal resistance

Compared to D2PAK, the thermal resistance of the product decreases by 20%



TOLL package combines size and thermal resistance perfectly, compared to D2PAK, the thermal resistance of the product decreases by 20%

1.2 TOLL MOSFET Advantages

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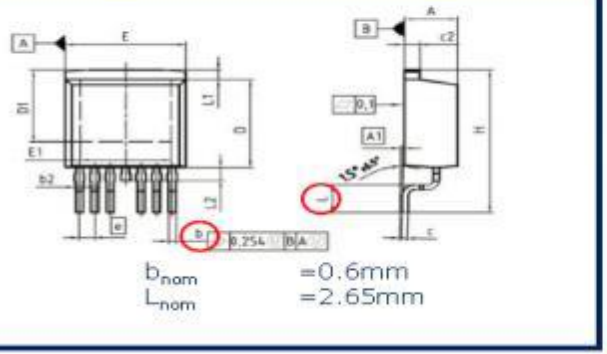
05

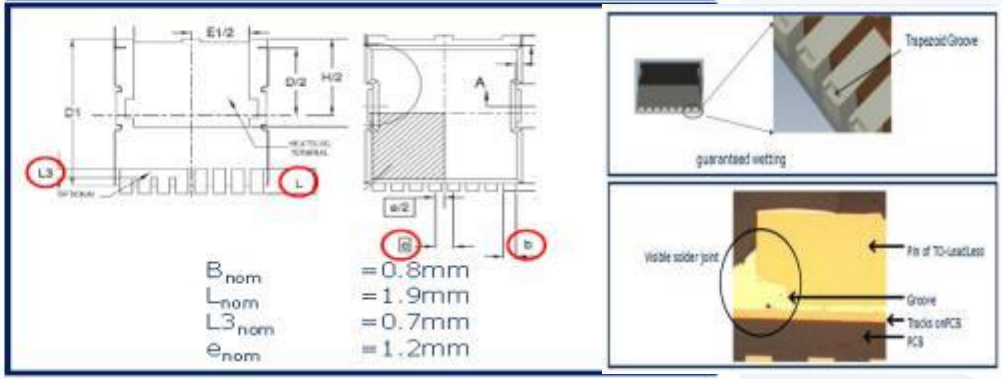
High device board level reliability

TOLL adopts a Wettable flange structure, which increases the pins' welding area by 55.6%, allowing for a lower current density, avoiding electromigration problems under high currents and temperatures, that improving reliability

D2PAK 7Pin



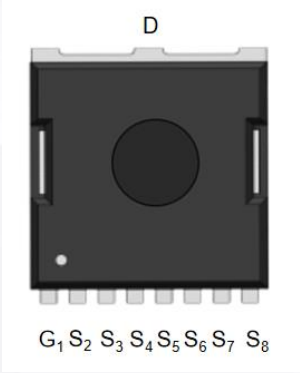
TO -LeadLess

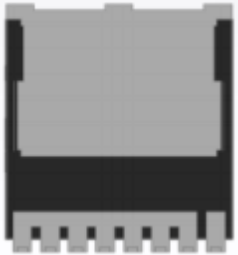


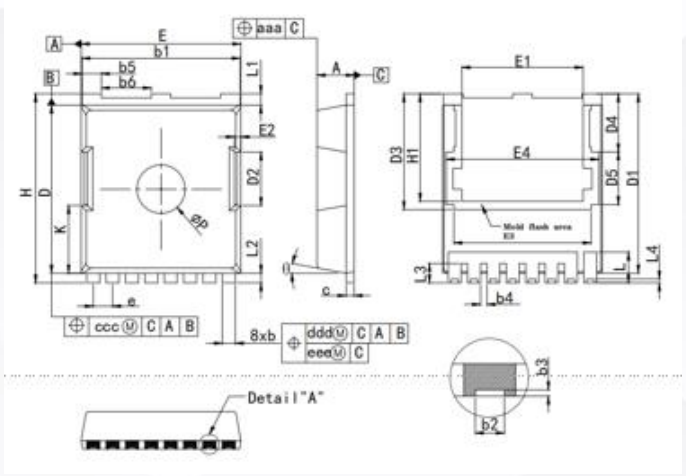
Contact/Solder area **D2PAK 7Pin:**
=2.65mm*0.6mm*5
= 7.95mm2

Contact/Solder area **TOLL:**
~1.9mm*0.8mm*7+0.7mm*0.4mm*6
= 12.32mm2

1.3 Product Size







SYMBOL	COMMON MILLIMETER		
	MIN	NOMINAL	MAX
A	2.20	2.30	2.40
b	0.70	0.80	0.90
b1	9.70	9.80	9.90
b2	0.36	0.45	0.55
b3	0.05	0.100	/
b4	0.30	0.40	0.50
b5	1.10	1.20	1.30
b6	3.00	3.10	3.20
c	0.40	0.50	0.60
D	10.28	10.38	10.55
D1	10.98	11.08	11.18
D2	3.20	3.30	3.40
D3		7.15	
D4		3.59	
D5		3.26	
e	1.10	1.20	1.30
E	9.80	9.90	10.00
E1	7.40	7.50	7.60
E2	0.30	0.40	0.50
E3		8.50	
E4		9.46	
H	11.50	11.68	11.85
H1	0.55	0.65	0.75
K	4.08	4.18	4.28
L	1.60	1.90	2.10
L1	0.50	0.70	0.90
L2	0.50	0.60	0.70
L3	1.00	1.20	1.30
L4	0.13	0.23	0.33
P	2.85	3.00	3.15
θ		10°REF	
aaa		0.20	
ccc		0.20	
ddd		0.25	
eee		0.20	

二、TOLL MOSFET Application

EV

PV

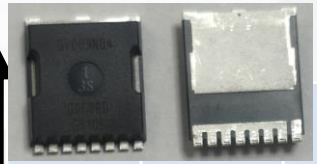
Power transmission

communication

UPS source

TOLL products are widely used in switches Power supply, data center (server power supply, etc.), charging station, power regulators for photovoltaic generators, and uninterruptible power supply systems (UPS).

三、TOLL MOSFET Planning



BVSDSS	0.5mΩ	1.0mΩ	1.5mΩ	2.0mΩ	2.5mΩ	4.0mΩ	7.0mΩ	10mΩ
200V SGT								200V (12mΩ)
150V SGT							150V（7mΩ）	
100V SGT		GT010N10TL (1.35mΩ)	GT016N10TL (1.6mΩ)	GT023N10TL (1.9mΩ)	100V (2.5mΩ)			
60V SGT		GT015N06TL (1.0mΩ)						
40V SGT		GT009N04TL (0.95mΩ)	GT014N04TL (1.2mΩ)	GT007N04TL (1.5mΩ)				
30V SGT		GT011N03TLE（1.0mΩ）						

Rdson max

Planned

Mass production

四、TOLL develop roadmap

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☐ Brief summary

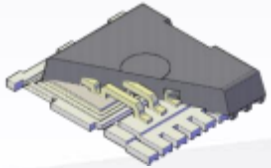
TOLL is a high-end MOSFET product with advanced technology. It will strengthen GOFORD competitiveness and increment close cooperation with customers.

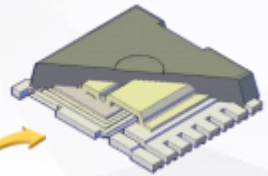
In order to better serve the market, Goford will introduce TOLL Ribbon, TOLL Clip, and TOLL high-voltage products to meet the diversified market demands.

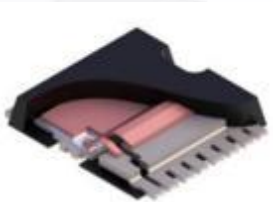
☐Continue R&D

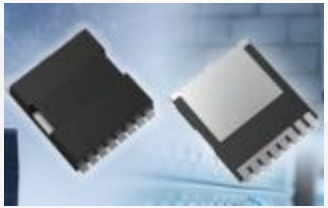
Cost Drive

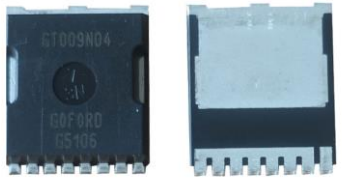
Performance Drive











AL wire Process

Ribbon Process

Clip Process

High voltage Process

TOLG

(TO Leaded with Gullwing)

2022 (developed)

2023~ 2024

Future direction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THANKS