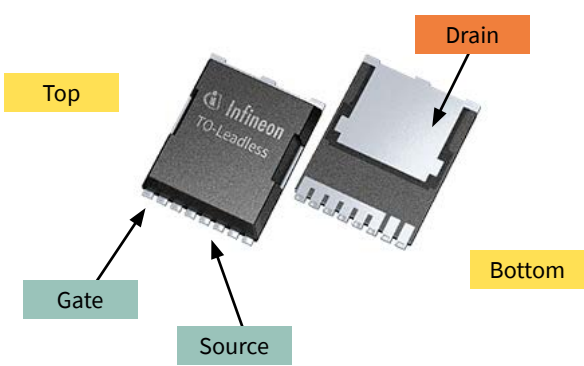
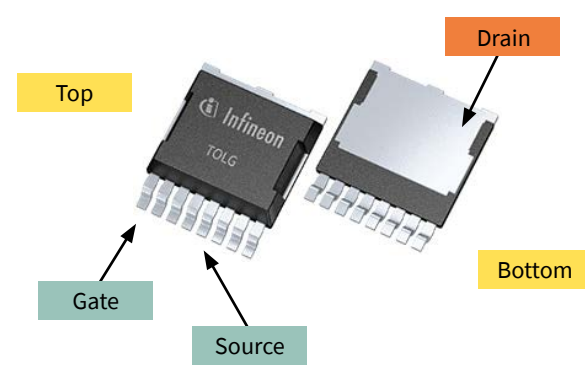
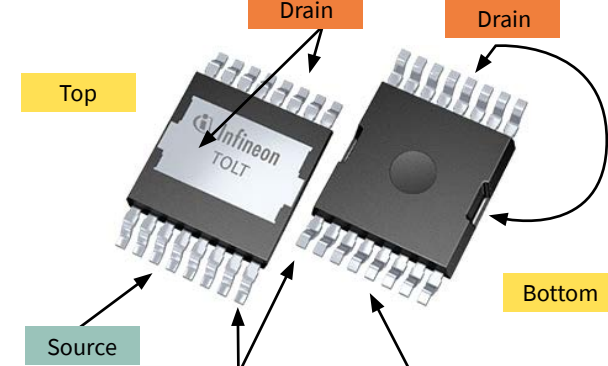




OptiMOS™ power MOSFETs in TOLx family

OptiMOS™ power MOSFETs in TOLx family

Three different packages addressing different requirements

		
<p>TOLL</p>	<p>TOLG</p>	<p>TOLT</p>
<p>TO-Leadless</p>	<p>TO-Leaded with gullwing</p>	<p>TO-Leaded top side cooling</p>
<p>Optimized for high-power applications</p>	<p>Optimized for better thermal cycling on board (TCoB) robustness</p>	<p>Optimized for superior thermal performance</p>

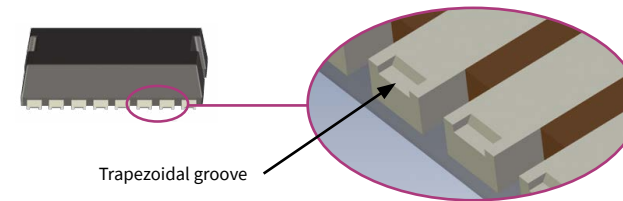
TO-Leadless

TO-Leadless offers the industry's lowest on-state resistance $R_{DS(on)}$ together with high current capability. This enables a reduction in the number of paralleled MOSFETs in high-power applications and increases power density. Additionally, 60% board space reduction is achievable compared to D²PAK 7-pin.

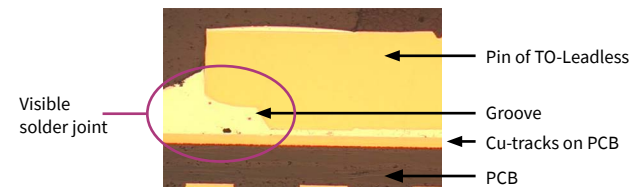
V_{DS} [V]	Part number	Technology	$R_{DS(on)}$ max. @ 10 V [mΩ]	I_D [A]
30	IPT004N03L	OptiMOS™ 5	0.40	300
40	IRL40T209	StrongIRFET™	0.72	586
60	IPT007N06N	OptiMOS™ 5	0.70	486
	IPT012N06N		1.20	313
80	IPT010N08NM5		1.05	425
	IPT012N08N5		1.20	400
	IPT014N08NM5		1.40	331
	IPT019N08N5		1.90	247
	IPT029N08N5		2.90	169
	IPT015N10N5		1.50	300
100	IPT020N10N5		2.00	260
	IPT026N10N5		2.60	202
120	IPT030N12N3	OptiMOS™ 3	3.00	237
200	IPT111N20NFD		11.0	96
250	IPT210N25NFD		21.0	59

Furthermore, TO-Leadless has a 50 percent larger solder contact area compared to the D²PAK 7-pin, enabling lower current density, avoiding electromigration at high current levels and temperatures, resulting in improved reliability. TO-Leadless is a package without leads allowing the possibility of optical inspection due to tin plated grooved gate and source contacts.

Tinned trapezoidal grooves on the tips of gate and source contacts



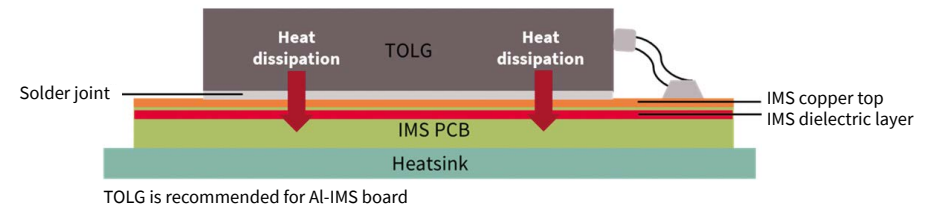
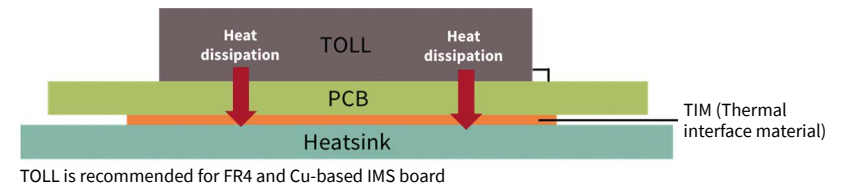
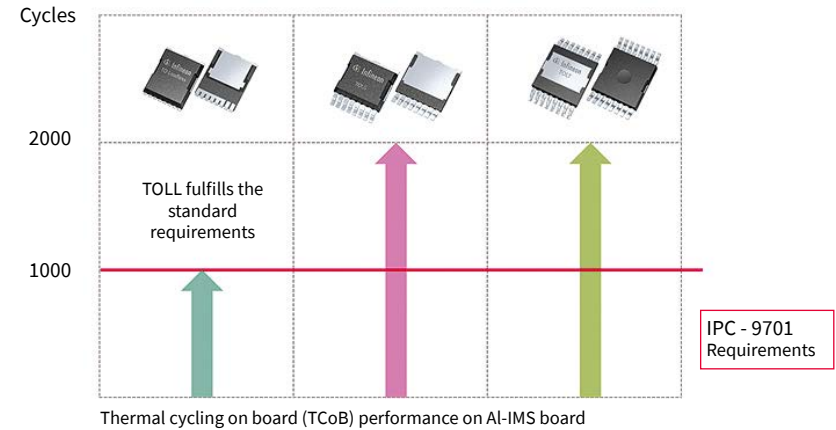
Visible solder meniscus allows a simple and inexpensive automatic optical inspection



TOLG – TO-Leaded with gullwing

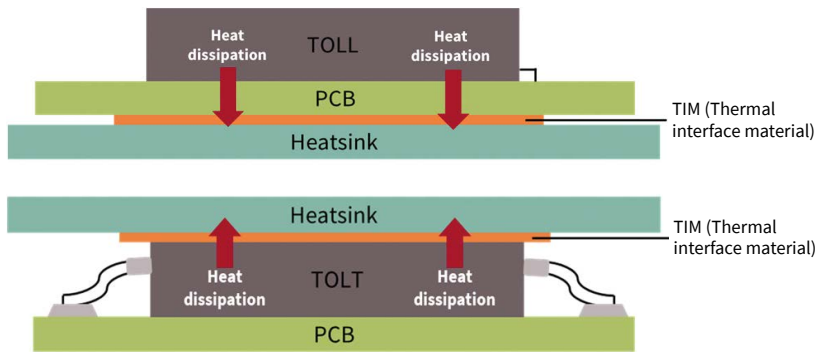
TOLG is the package encompassing the best features from both TO-Leadless and D²PAK 7-pin. It has the same footprint and excellent electrical performance as TOLL. The advantage of TOLG is the flexibility enabled by the gullwing leads, which offer better joint reliability on the Aluminum-IMS board. Thanks to this feature TOLG achieves two times better Thermal Cycling on Board (TCoB) performance compared to IPC-9701 standard requirements.

Voltage class [V]	Part number	$R_{DS(on), max.}$ @ 10 V [mΩ]	I_D [A]
60	IPTG007N06NM5	0.75	454
80	IPTG011N08NM5	1.10	408
	IPTG018N08NM5	1.80	253
	IPTG025N08NM5	2.50	184
100	IPTG014N10NM5	1.40	366
	IPTG018N10NM5	1.80	273
	IPTG025N10NM5	2.50	206
200	IPTG111N20NM3FD	11.10	77
250	IPTG210N25NM3FD	21.00	108



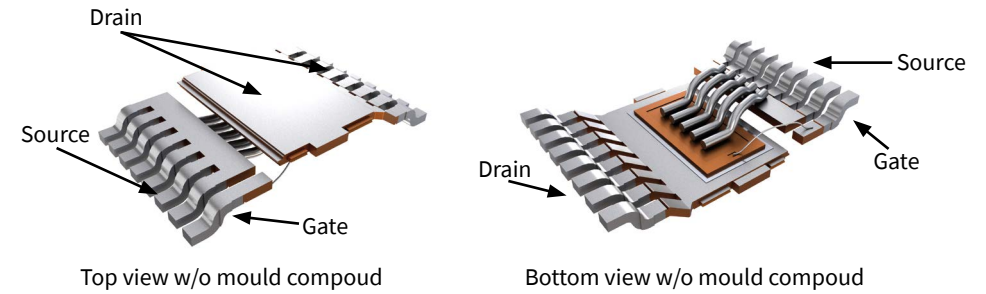
TOLT – TO-Leaded top side cooling

TOLT package offers the same high current low profile benefits as the TOLL package with the additional advantage of top-side cooling for optimum thermal performance.

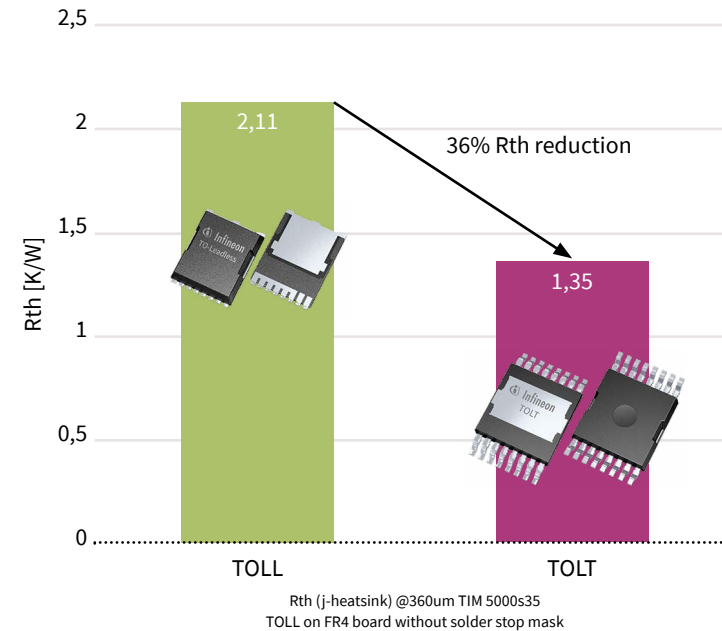


With bottom-side cooling packages, like the TOLL or the D²PAK, the heat is dissipated via the PCB to the heatsink resulting in high power losses. With top-side cooling, the drain is exposed at the surface of the package allowing the heat to be dissipated directly to the heatsink, achieving 20% better RthJA and 50 percent improved RthJC compared to the TOLL package.

Voltage class [V]	Part number	R _{DS(on)} max. @ 10 V [mΩ]	I _D [A]
80	IPTC012N08NM5	1.2	396
	IPTC014N08NM5	1.4	330
100	IPTC015N10NM5	1.5	354
	IPTC019N10NM5	1.9	279



TOLT vs. TOLL - Thermal comparison



To meet the same current handling as the bottom side cooling package, it is possible to significantly reduce the heatsink size with TOLT package achieving lower system cost.

Package	TOLx family features	TOLx family benefits	Package key features	Package key benefits	Target applications
TOLL	<p>Low $R_{DS(on)}$</p> <p>High current rating</p> <p>Lower ringing and voltage overshoot compared to D²PAK</p>	<p>Reduction in conduction losses</p> <p>High power density, system efficiency and extended lifetime</p> <p>Higher efficiency by lower switching losses and lower EMI</p>	60% board space reduction compared to D ² PAK 7pin	High power density	Light electric vehicles
TOLG			Gullwing leads	Superior thermal cycling on board (TCoB) capability	E-scooter
TOLT			Top side cooling	Superior thermal performance	E-bikes
			Negative stand-off	Minimize thermal resistance to heatsink	Battery management system
					Hotswap
					Power and gardening tools
					Drones
					Robotics