MOSFET Silicon N-Channel MOS

1. Applications

Synchronous rectification in SMPS,
Hard switching and High speed circuit
DC/DC in telecoms and industrial

2. Features

Low drain-source on-resistance:
RDS(on) TOLL = 1.6mΩ (typ.)
RDS(on) TO247 = 2.1mΩ (typ.)
High speed power switching
Enhanced body diode dv/dt capability
Enhanced avalanche ruggedness

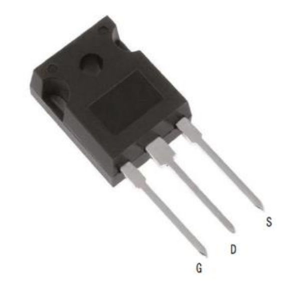
Table 1 Key Performance Parameters

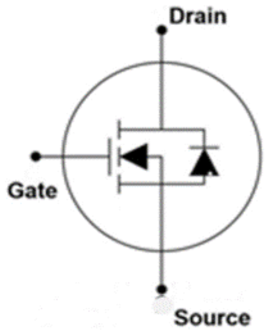
Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	100	V
$R_{DS(on),max\ TOLL}$	2.0	mΩ
$R_{DS(on),max\ TO247}$	2.5	mΩ
$Q_{g,typ}$	213	nC
$I_{D,pulse}$	1000	A

3. Packaging and Internal Circuit

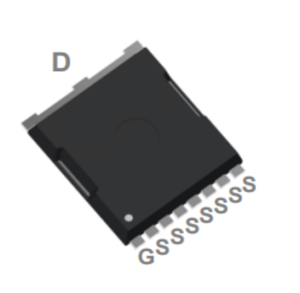
Part Name	Package	Marking
AUR020N10	TOLL-8L	AUR020N10
AUW025N10	TO247-3L	AUW025N10

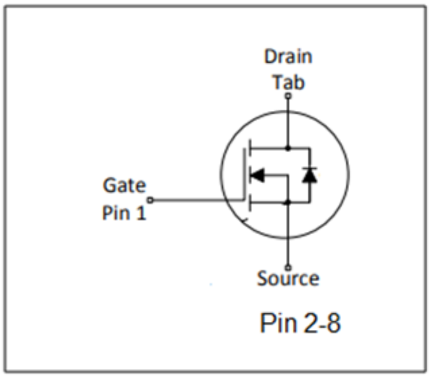
TO247-3L





TOLL





1 Maximum ratings

at T_j = 25°C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current[1]	I_D		-	305	A	T_C=25°C
Pulsed drain current[2]	$I_{D,pulse}$	-	-	1000	A	T_C=25°C
Avalanche energy, single pulse	E_{AS}	-	-	1176	mJ	Tc=25°C,VDD=50V, Iav=68.6A, L=0.5mH, RG=25Ω
Avalanche current, single pulse	I_{AR}	-	-	68.6	A	Tc=25°C,VDD=50V, L=0.5mH, RG=25Ω
Gate source voltage (static)	V_{GS}	-20	-	20	V	static;
Power dissipation	P_{tot}	-	-	375	W	T_C=25°C
Storage temperature	T_{stg}	-55	-	150	°C	
Operating junction temperature	T_j	-55	-	150	°C	
Soldering Temperature Distance of 1.6mm from case for 10s	T_L			260	°C	

[1] Limited by $T_{j,max}$. Maximum Duty Cycle D = 0.50
[2] Pulse width t_p limited by $T_{j,max}$
[3] Identical low side and high side switch with identical R_G

2 Thermal characteristics

Table Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	0.33	°C/W	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	48	°C/W	device on PCB, minimal footprint

3 Electrical characteristics

at T_j=25°C, unless otherwise specified

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	100	-	-	V	V_{GS}=0V, I_D=250uA
Gate threshold voltage	$V_{(GS)th}$	2.5	3.1	4.5	V	V_{DS}=V_{GS}, I_D=250uA
Zero gate voltage drain current	I_{DSS}	-	-	1	uA	V_{DS}=100V, V_{GS}=0V, T_j=25°C
Gate-source leakage current	I_{GSS}	-	-	±100	nA	V_{GS}=±20V, V_{DS}=0V
Drain-source on-state resistance(TOLL)	$R_{DS(on)}$	-	1.6	2.0	mΩ	V_{GS}=10V, I_D=20A, T_j=25°C
Drain-source on-state resistance(TO247)	$R_{DS(on)}$	-	2.1	2.5	mΩ	V_{GS}=10V, I_D=20A, T_j=25°C
Gate resistance (Intrinsic)	R_G	-	1.6	-	Ω	f=1MHz, open drain
Transconductance	Gfs	-	138.4	-	S	V_{DS}=5V, I_D=50A

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	14994	-	pF	V_{GS}=0V, V_{DS}=35V, f=1MHz
Output capacitance	C_{oss}	-	1577	-	pF	V_{GS}=0V, V_{DS}=35V, f=1MHz
Reverse transfer capacitance	C_{rss}	-	477	-	pF	V_{GS}=0V, V_{DS}=35V, f=1MHz
Turn-on delay time	$t_{d(on)}$	-	35.5	-	ns	V_{DD}=50V,V_{GS}=10V,I_D=20A, R_G=3Ω
Rise time	t_r	-	57.2	-	ns	V_{DD}=50V,V_{GS}=10V,I_D=20A, R_G=3Ω
Turn-off delay time	$t_{d(off)}$	-	112	-	ns	V_{DD}=50V,V_{GS}=10V,I_D=20A, R_G=3Ω
Fall time	t_f	-	62	-	ns	V_{DD}=50V,V_{GS}=10V,I_D=20A, R_G=3Ω

Table 6 Gate charge characteristics

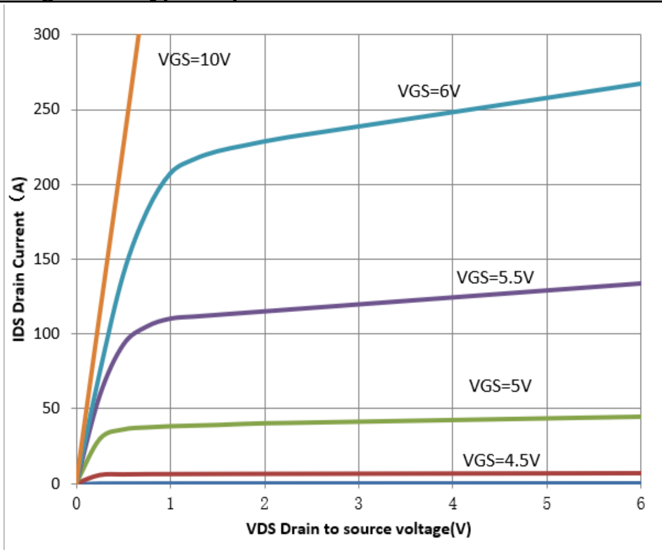
Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	60.6	-	nC	V_{DD}=50V, I_D=20A, V_{GS}=0 to 10V
Gate to drain charge	Q_{gd}	-	50.7	-	nC	V_{DD}=50V, I_D=20A, V_{GS}=0 to 10V
Gate charge total	Q_g	-	213	-	nC	V_{DD}=50V, I_D=20A, V_{GS}=0 to 10V
Gate plateau voltage	$Vplateau$	-	4.72	-	V	V_{DD}=50V, I_D=20A, V_{GS}=0 to 10V

Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	-	0.67	1.2	V	V_{GS}=0V, I_F=1A, T_j=25°C
Reverse recovery time	t_{rr}	-	84.44	-	ns	V_R=50V, I_F=20A, di_F/dt=100A/µs
Reverse recovery charge	Q_{rr}	-	236	-	nC	V_R=50V, I_F=20A, di_F/dt=100A/µs
Peak reverse recovery current	I_{rrm}	-	4.31	-	A	V_R=50V, I_F=20A, di_F/dt=100A/µs

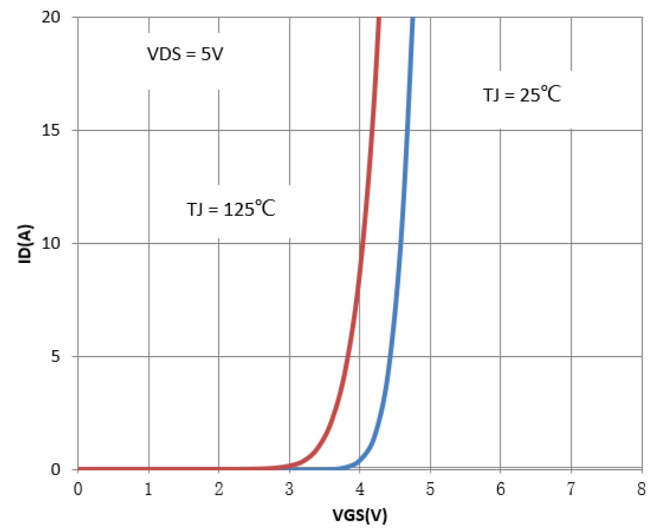
4 Electrical characteristics diagram

Diagram 1: Typ. Output characteristics



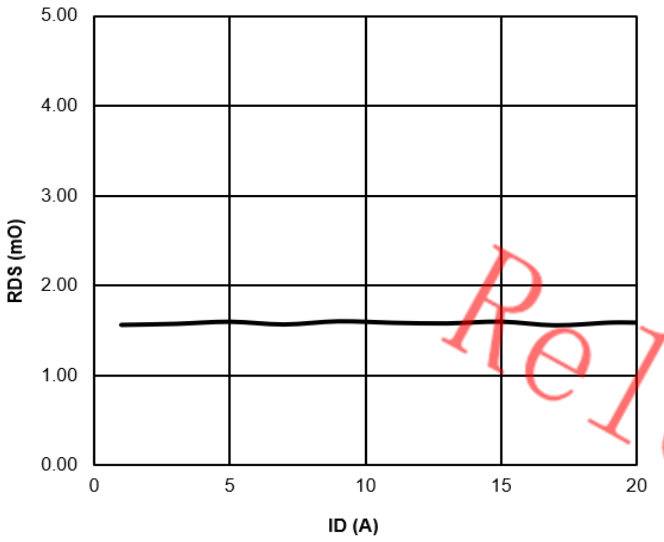
I_D=f(V_{DS});T_j=25 °C; parameter: V_{GS}

Diagram 2: Typ. transfer characteristics



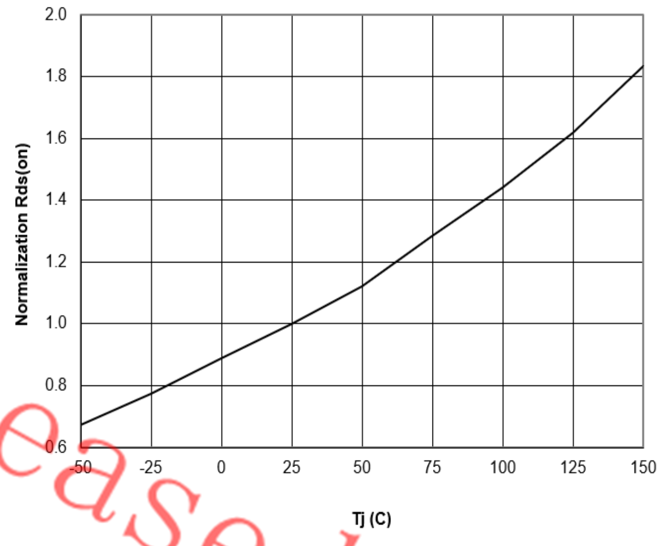
ID=f(VGS); VDS=5V; parameter:Tj

Diagram 3: Typ. On-Resistance vs. ID (TOLL)



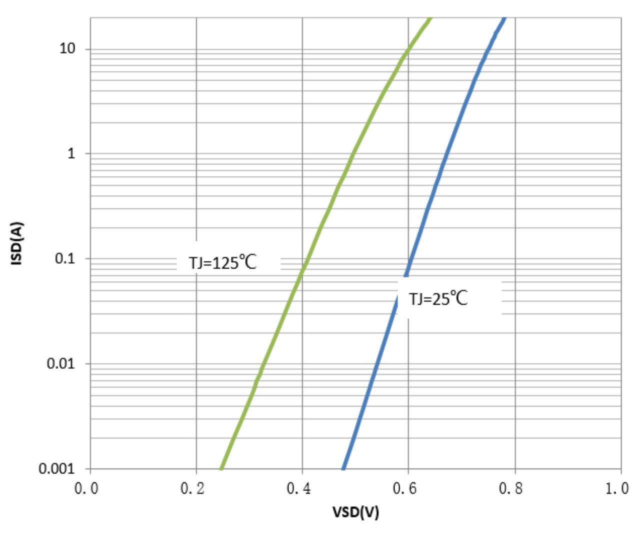
$R_{DS(on)}$=f(I_D); T_j=25°C; parameter:V_{GS}=10V(TOLL)

Diagram 4: Typ. Rdson – Junction Temperature



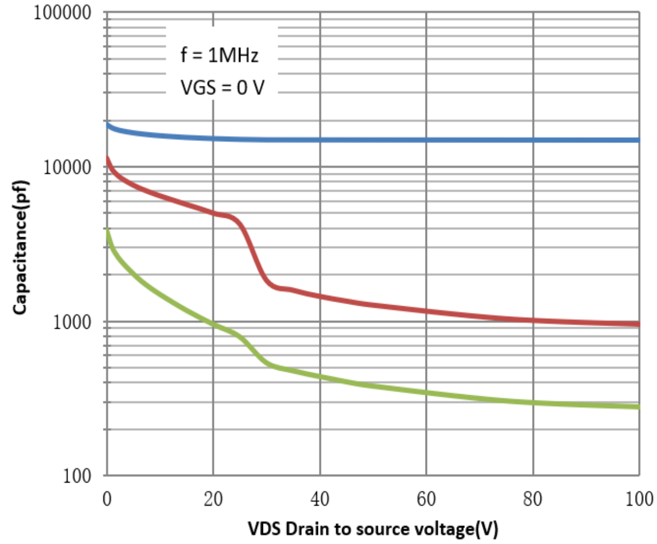
($R_{ds(on)}$=f(T_j);Vgs=10V/I_D=20A

Diagram 5: Typ. Body-Diode Characteristics



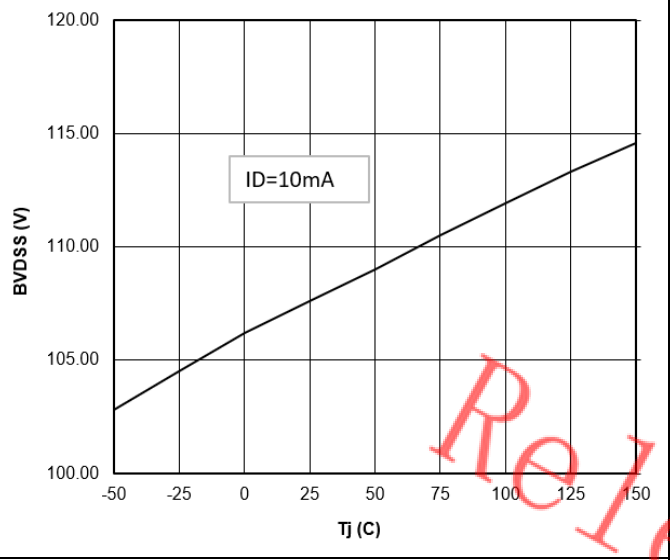
I_F=f(V_{DS});parameter: Tj

Diagram 6: Typ. Capacitance vs. Vds



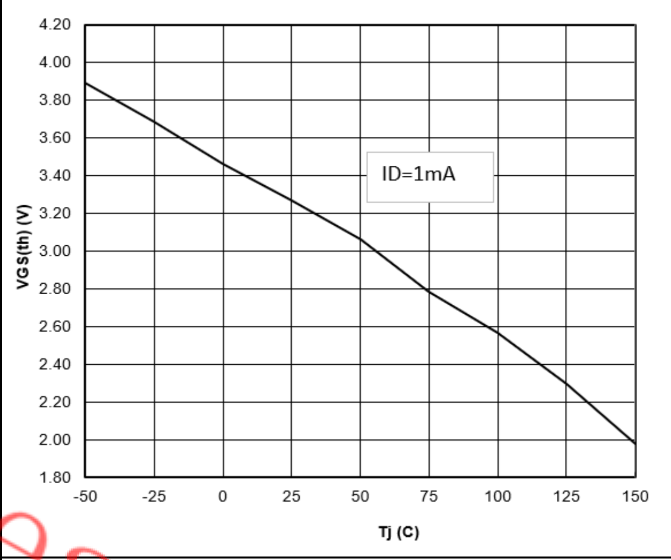
C=f(V_{DS});V_{GS}=0V; f=1MHz

Diagram 7: Typ. Drain-source breakdown voltage



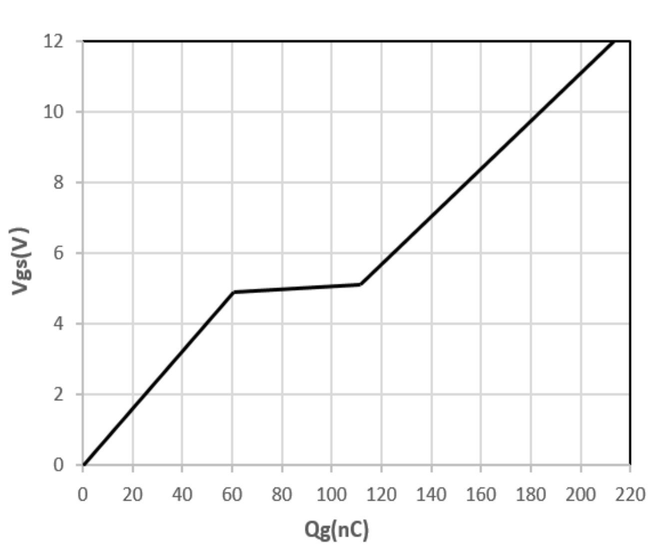
$V_{BR(DSS)}=f(T_j)$; $I_D=10mA$

Diagram 8: Typ. Threshold voltage



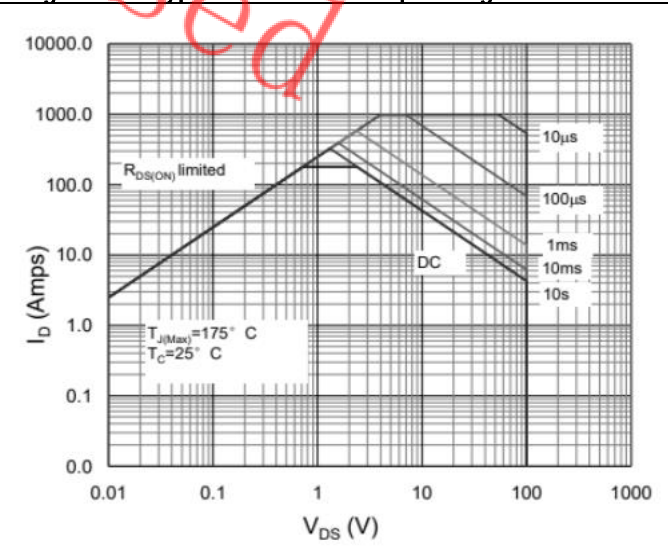
$Vth=f(T_C)$;

Diagram 9: Typ. Gate charge



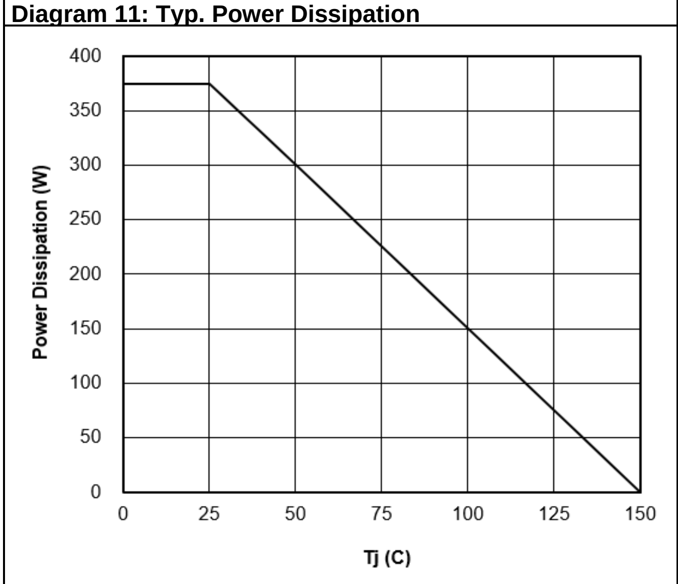
$V_{GS}=f(Q_{gate})$; I_D=20A pulsed; parameter: V_{DD}

Diagram 10: Typ. Maximum Safe Operating Area



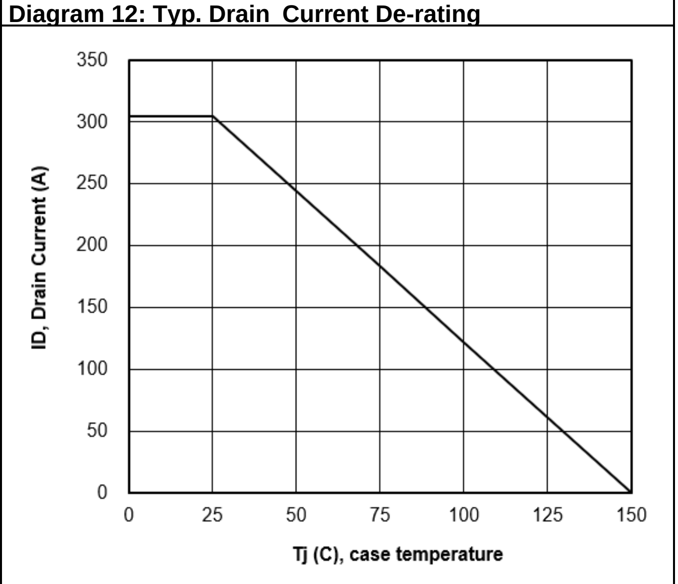
$I_D=f(V_{DS})$; T_C=25 °C; D=0; parameter tp

Diagram 11: Typ. Power Dissipation



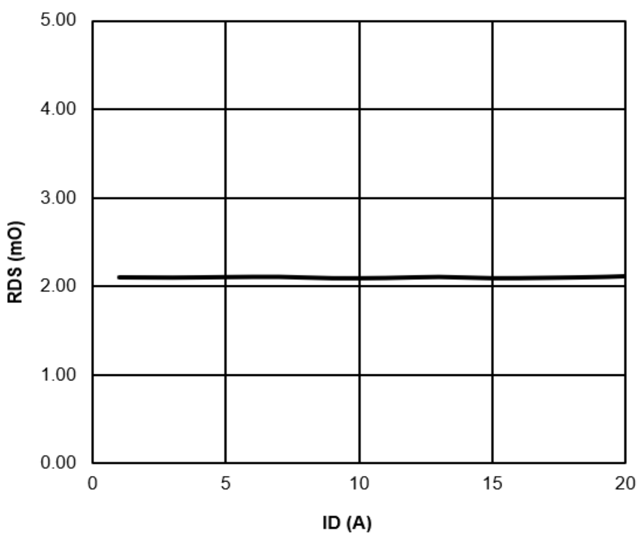
$P_{tot}=f(T_C)$;

Diagram 12: Typ. Drain Current De-rating



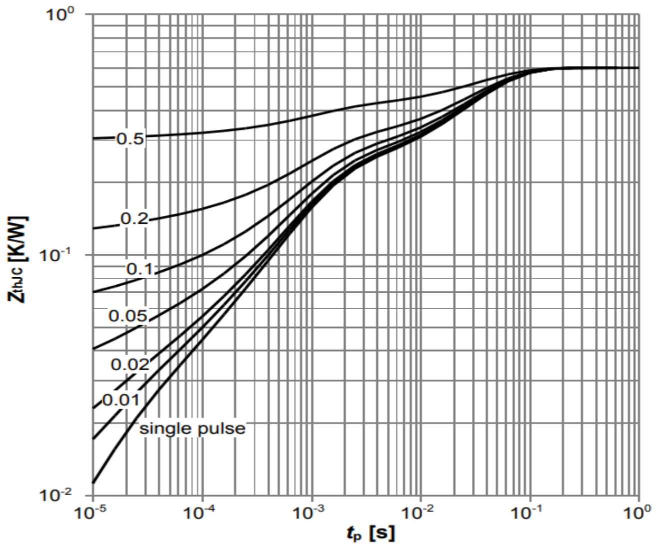
$Id=f(T_C)$;

Diagram 13: Typ. On-Resistance vs. ID (TO247)



$R_{DS(on)}$=f(I_D); T_j=25°C; parameter:V_{GS}=10V(TO247)

Diagram 14: Typ. Max. transient thermal impedance



Z_{thJC} =f(t_P); parameter: D=t_p/T

5 Test Circuits

Table 8 Diodecharacteristics

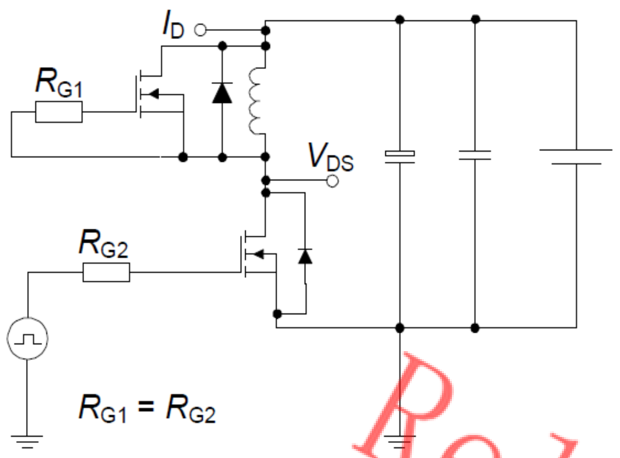
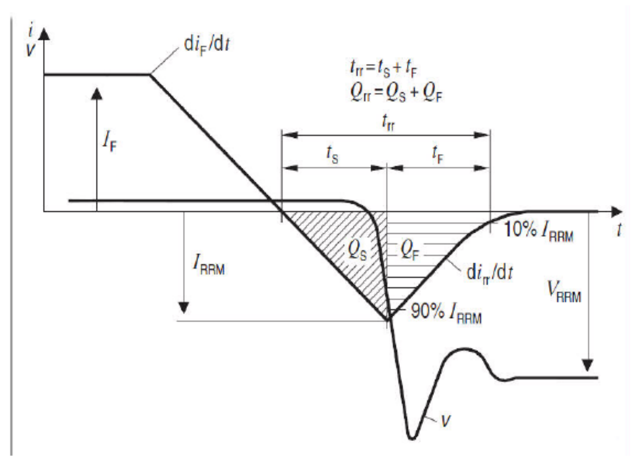
Test circuit for diode characteristics	Diode recovery waveform
	

Table 9 Switching times

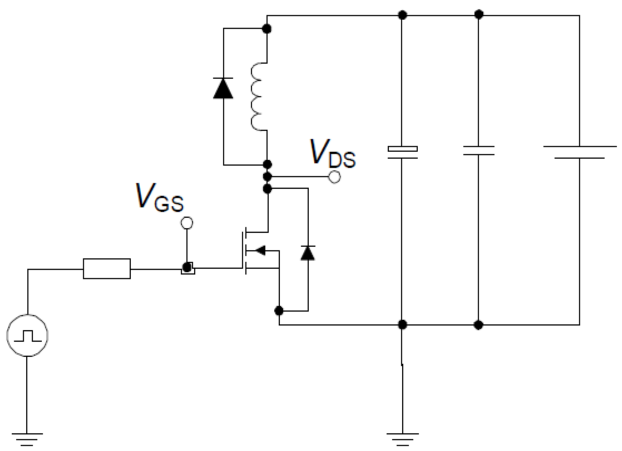
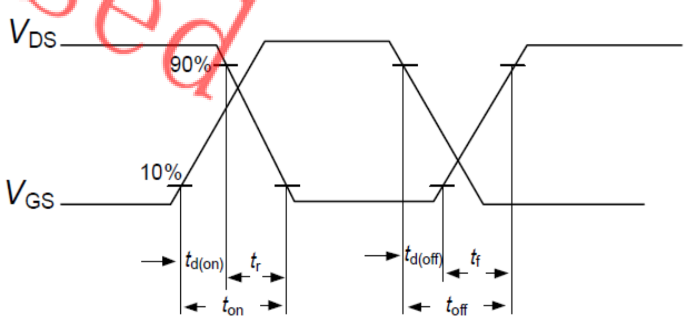
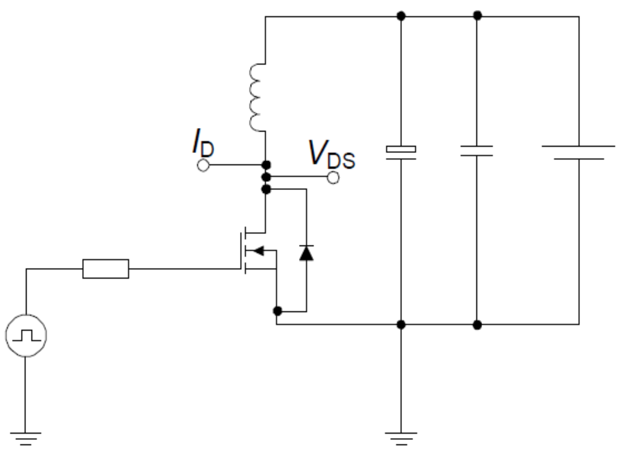
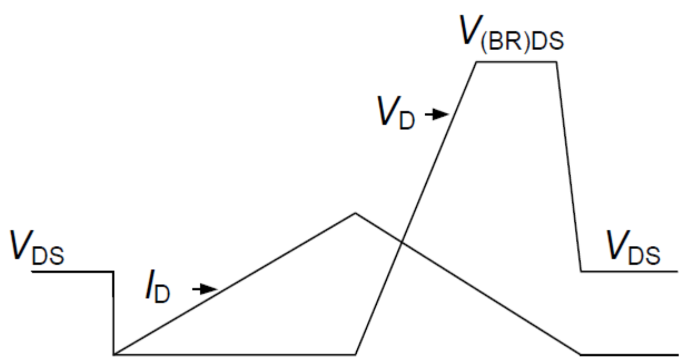
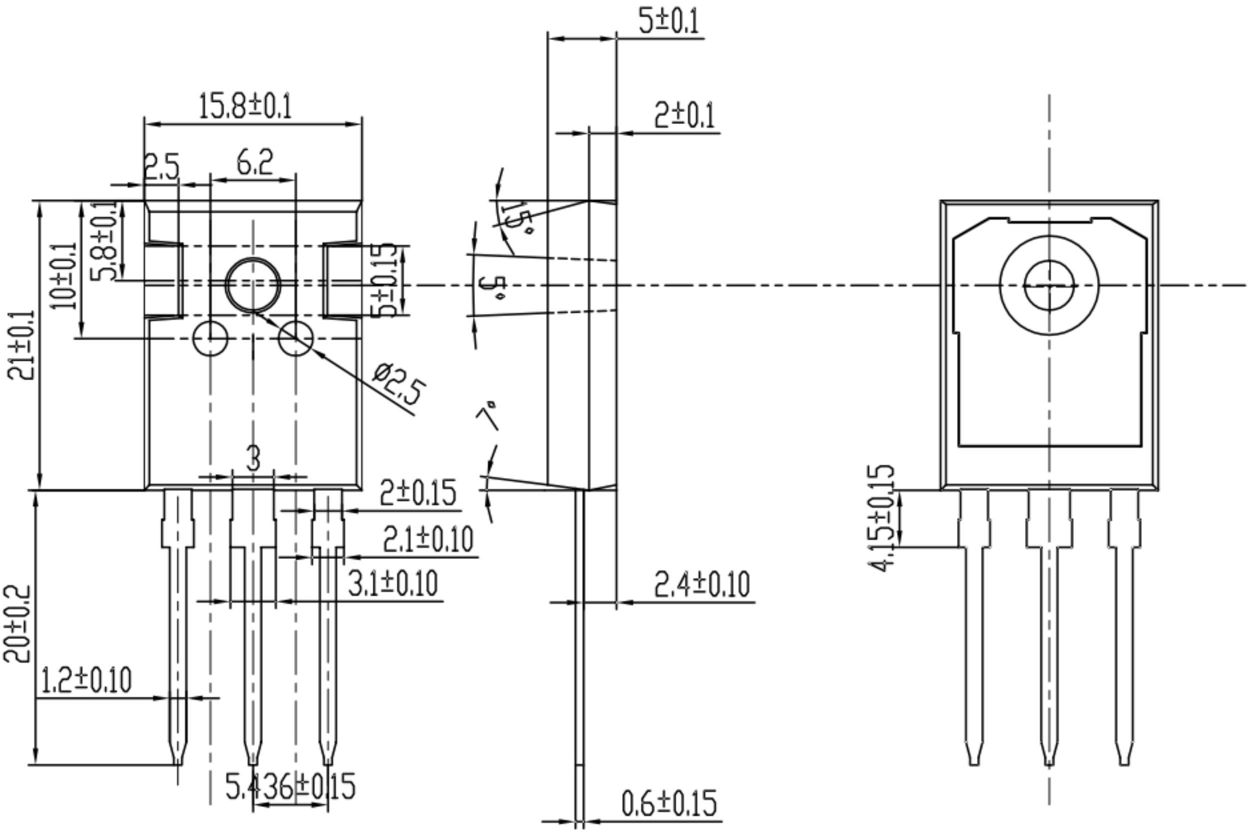
Switching times test circuit for inductive load	Switching times waveform
	

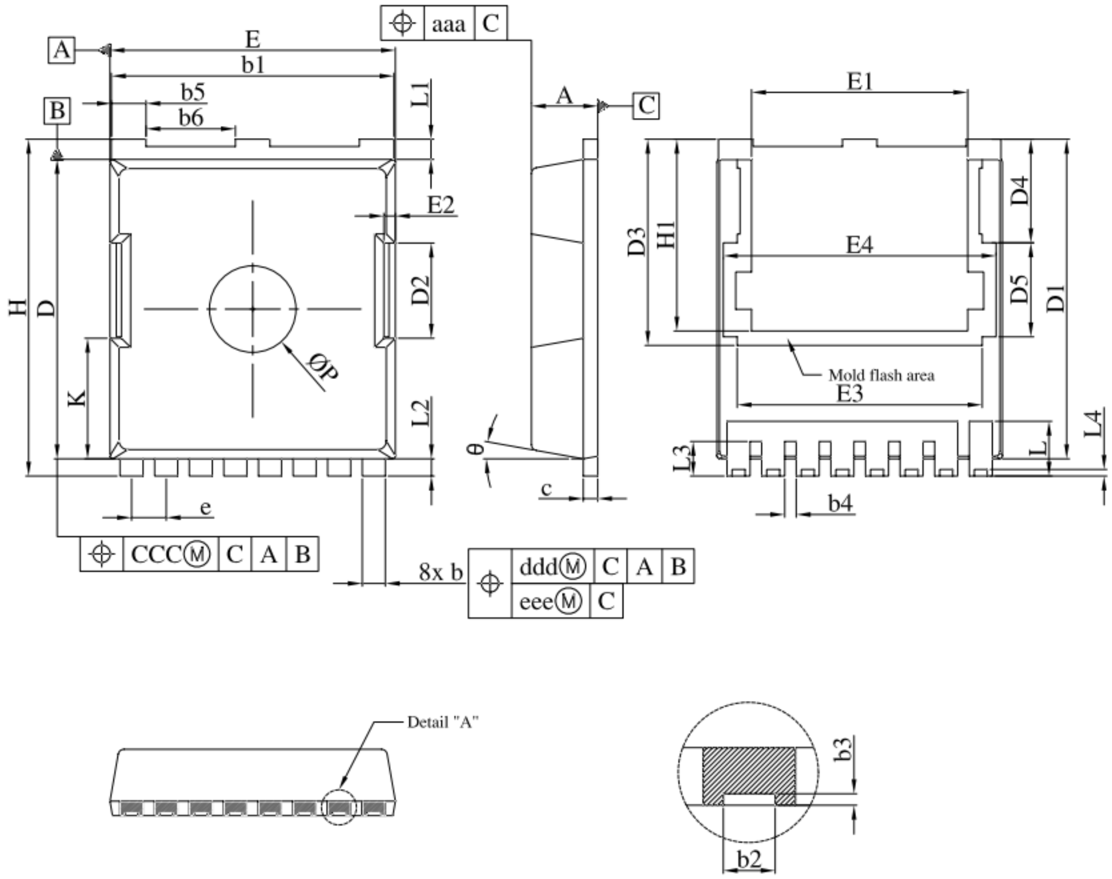
Table 10 Unclamped inductive load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

6 Package Outlines



Outline PG-TO247-3L(HT)



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	6.55	6.65	6.75
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	

Outline PG-TOLL(JQ)

Revision History

Revision	Date	Subjects (major changes since last revision)
1.0	2023-12-11	Preliminary version