

MOSFET Silicon N-Channel MOS



1. Applications

Single-ended flyback or two-transistor forward topologies.
PC power, PD Adaptor, LCD & PDP TV and LED lighting.

2. Features

Low drain-source on-resistance: $R_{DS(ON)} = 39m\Omega$ (typ.)
Easy to control Gate switching
Enhancement mode: $V_{th} = 3.2$ to 4.5 V

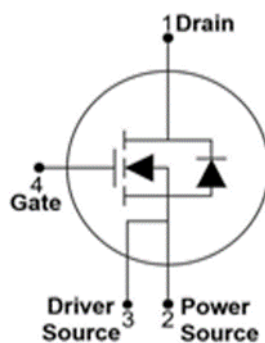
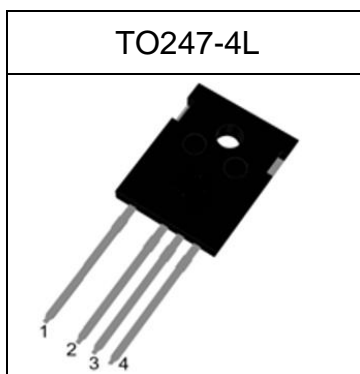
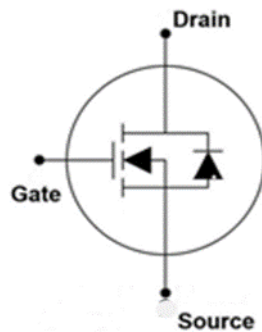
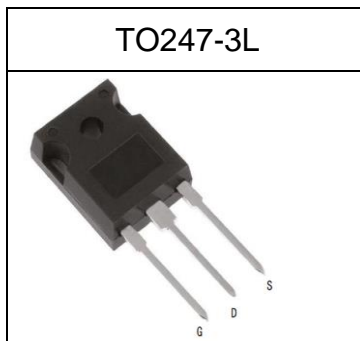


Table 1 Key Performance Parameters

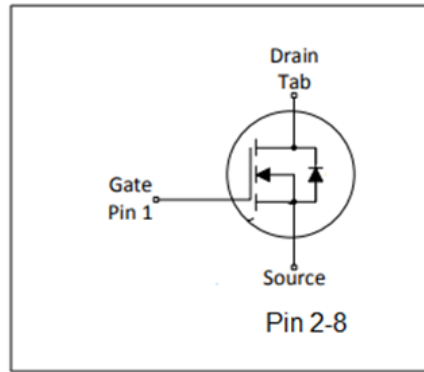
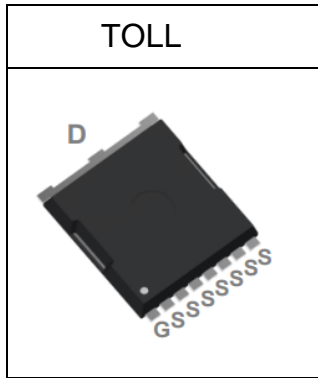
Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	700	V
$R_{DS(on),max}$	46	m Ω
$Q_{g,typ}$	111	nC
$I_{D,pulse}$	236	A
Body diode dv/dt	50	V/ns

3. Packaging and Internal Circuit

Part Name	Package	Marking
ASW65R046EFD	TO247-3L	ASW65R046EFD
ASQ65R046EFD	TO247-4L	ASQ65R046EFD
ASR65R046EFD	TOLL-8L	ASR65R046EFD



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1 Maximum ratings

at $T_j = 25^\circ\text{C}$, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current ¹⁾	I_D		-	59	A	$T_C=25^\circ\text{C}$
Pulsed drain current ²⁾	$I_{D,pulse}$	-	-	236	A	$T_C=25^\circ\text{C}$
Avalanche energy, single pulse	E_{AS}	-	-	414	mJ	$T_C=25^\circ\text{C}$, $V_{DD}=50\text{V}$, $I_{av}=9.1\text{A}$, $L=10\text{mH}$, $R_G=25\Omega$
Avalanche current, single pulse	I_{AR}	-	-	9.1	A	$T_C=25^\circ\text{C}$, $V_{DD}=50\text{V}$, $L=10\text{mH}$, $R_G=25\Omega$
MOSFET dv/dt ruggedness	dv/dt	-	-	50	V/ns	$V_{DS}=0\dots400\text{V}$
Gate source voltage (static)	V_{GS}	-20	-	20	V	static;
Gate source voltage (dynamic)	V_{GS}	-30	-	30	V	AC ($f>1\text{ Hz}$)
Power dissipation	P_{tot}	-	-	347	W	$T_C=25^\circ\text{C}$
Storage temperature	T_{stg}	-55	-	150	$^\circ\text{C}$	
Operating junction temperature	T_j	-55	-	150	$^\circ\text{C}$	
Soldering Temperature Distance of 1.6mm from case for 10s	T_L			260	$^\circ\text{C}$	
Reverse diode dv/dt ³⁾	dv/dt	-	-	15	V/ns	$V_{DS}=0\dots400\text{V}$, $I_{SD}\leq 58\text{A}$, $T_j=25^\circ\text{C}$

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

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2 Thermal characteristics

Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	0.36	°C/W	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	46.2	°C/W	device on PCB, minimal footprint

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3 Electrical characteristics

at $T_j=25^\circ\text{C}$, unless otherwise specified

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	650	-	-	V	$V_{GS}=0V, I_D=250\mu A$
Gate threshold voltage	$V_{(GS)th}$	3.2	3.9	4.5	V	$V_{DS}=V_{GS}, I_D=250\mu A$
Zero gate voltage drain current	I_{DSS}	-	-	3	μA	$V_{DS}=650V, V_{GS}=0V, T_j=25^\circ C$
Gate-source leakage current	I_{GSS}	-	-	100	nA	$V_{GS}=30V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	39	46	m Ω	$V_{GS}=10V, I_D=29.4A, T_j=25^\circ C$
Gate resistance (Intrinsic)	R_G	-	3.5	-	Ω	$f=1MHz, \text{open drain}$

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	5309	-	pF	$V_{GS}=0V, V_{DS}=100V, f=1MHz$
Output capacitance	C_{oss}	-	101.8	-	pF	$V_{GS}=0V, V_{DS}=100V, f=1MHz$
Reverse transfer capacitance	C_{rss}	-	10.73	-	pF	$V_{GS}=0V, V_{DS}=100, f=1MHz$
Turn-on delay time	$t_{d(on)}$	-	14.4	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=44.2A, R_G=1.8\Omega$
Rise time	t_r	-	35.1	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=44.2A, R_G=1.8\Omega$
Turn-off delay time	$t_{d(off)}$	-	86.2	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=44.2A, R_G=1.8\Omega$
Fall time	t_f	-	6.4	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=44.2A, R_G=1.8\Omega$

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	28.0	-	nC	$V_{DD}=480V, I_D=44.2A, V_{GS}=0 \text{ to } 10V$
Gate to drain charge	Q_{gd}	-	48.3	-	nC	$V_{DD}=480V, I_D=44.2A, V_{GS}=0 \text{ to } 10V$
Gate charge total	Q_g	-	111	-	nC	$V_{DD}=480V, I_D=44.2A, V_{GS}=0 \text{ to } 10V$
Gate plateau voltage	$V_{plateau}$	-	6.18	-	V	$V_{DD}=480V, I_D=44.2A, V_{GS}=0 \text{ to } 10V$

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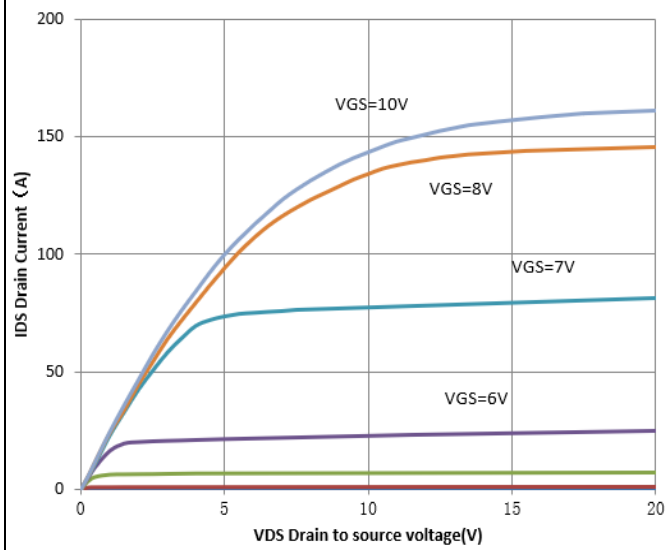
Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	-	0.65	-	V	$V_{GS}=0V, I_F=1A, T_J=25^{\circ}C$
Reverse recovery time	t_{rr}	-	168.9	-	ns	$V_R=400V, I_F=44.2A, di_F/dt=100A/\mu s$
Reverse recovery charge	Q_{rr}	-	1.44	-	μC	$V_R=400V, I_F=44.2A, di_F/dt=100A/\mu s$
Peak reverse recovery current	I_{rrm}	-	15.67	-	A	$V_R=400V, I_F=44.2A, di_F/dt=100A/\mu s$

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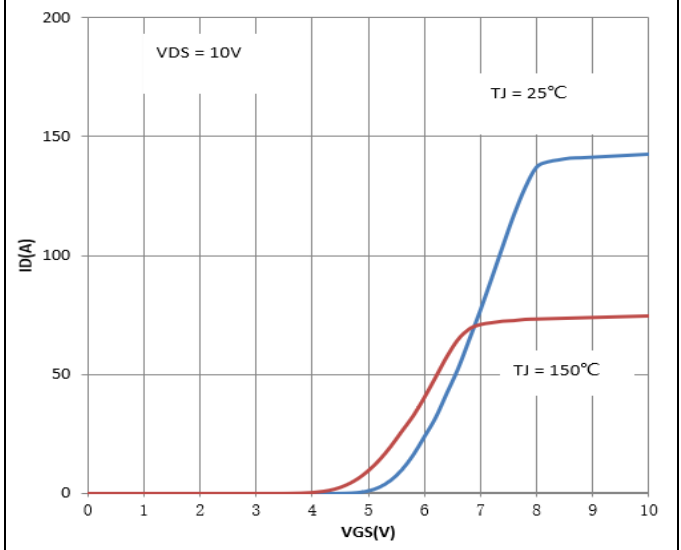
4 Electrical characteristics diagram

Diagram 1: Typ. Output characteristics



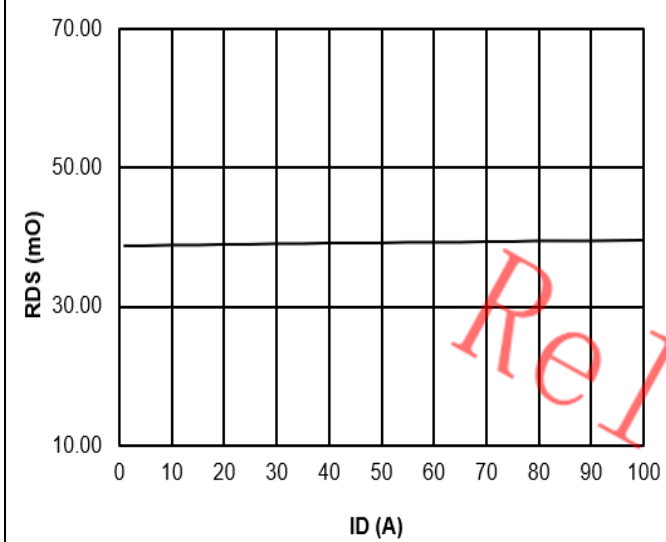
$I_D=f(V_{DS}); T_j=25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 2: Typ. transfer characteristics



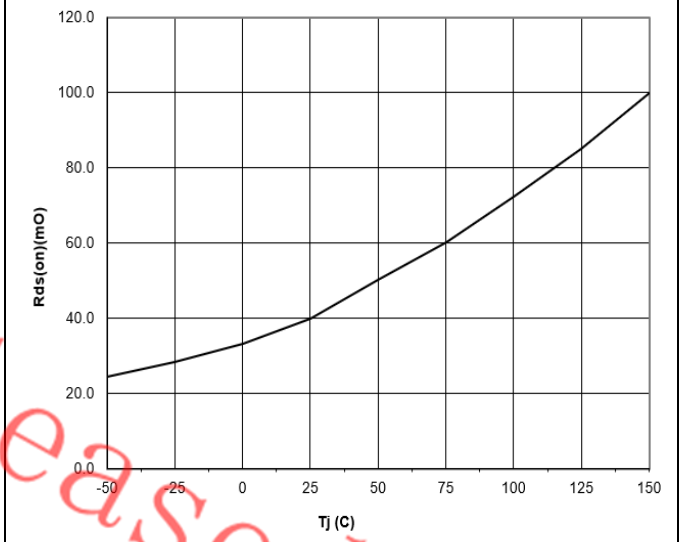
$I_D=f(V_{GS}); V_{DS}=10\text{V}; \text{parameter: } T_j$

Diagram 3: Typ. On-Resistance vs. ID



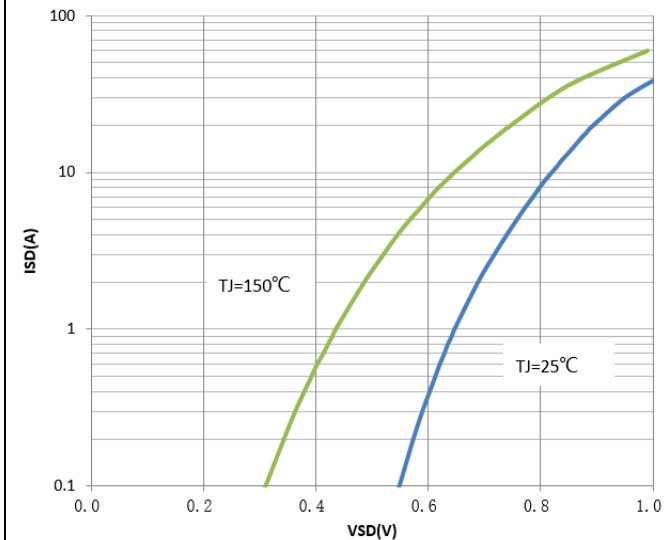
$R_{DS(on)}=f(I_D); T_j=25^\circ\text{C}; \text{parameter: } V_{GS}=10\text{V}$

Diagram 4: Typ. Rdson – Junction Temperature



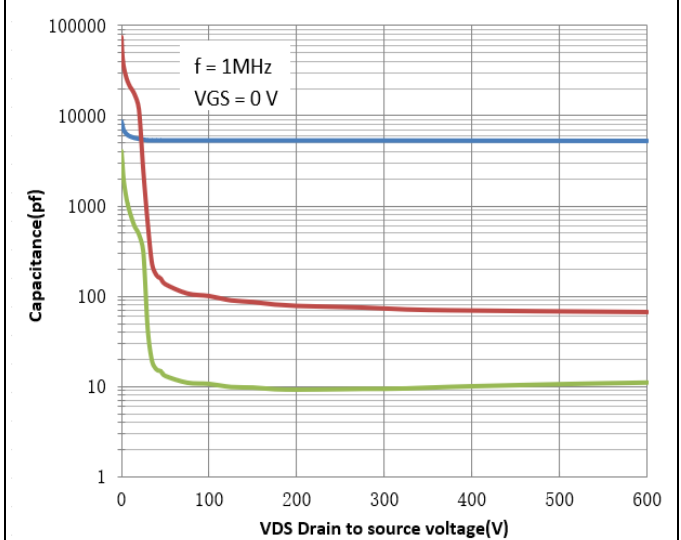
$R_{DS(on)}=f(T_j); V_{GS}=10\text{V}/I_D=29.4\text{A}$

Diagram 5: Typ. Body-Diode Characteristics



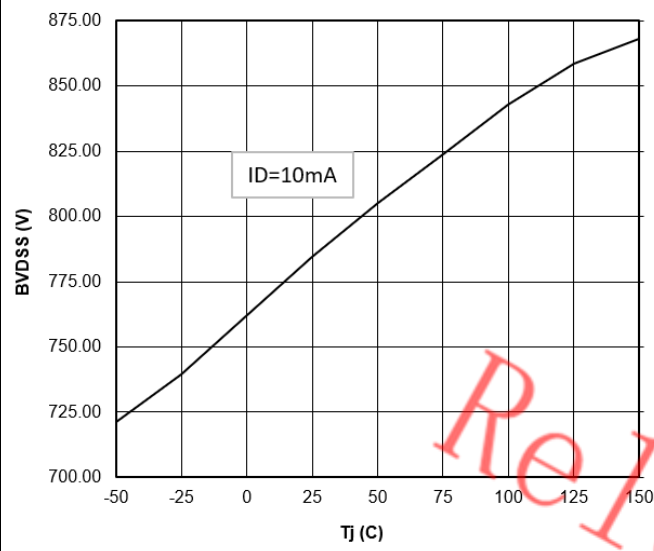
$I_F=f(V_{DS}); \text{parameter: } T_j$

Diagram 6: Typ. Capacitance vs. Vds



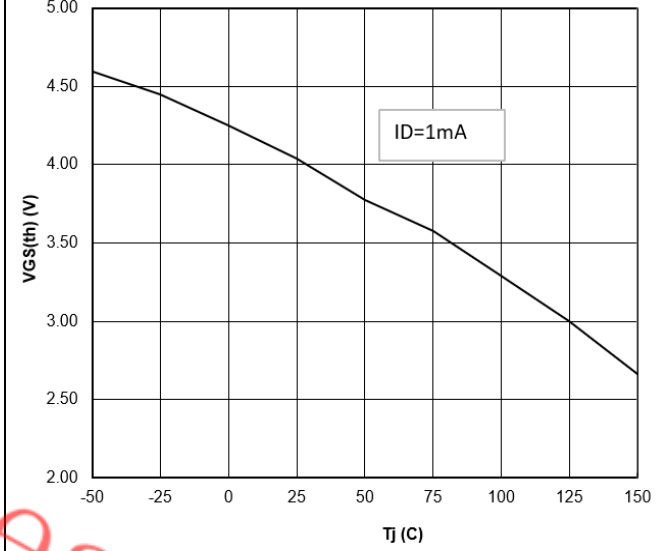
$C=f(V_{DS}); V_{GS}=0\text{V}; f=1\text{MHz}$

Diagram 7: Typ. Drain-source breakdown voltage



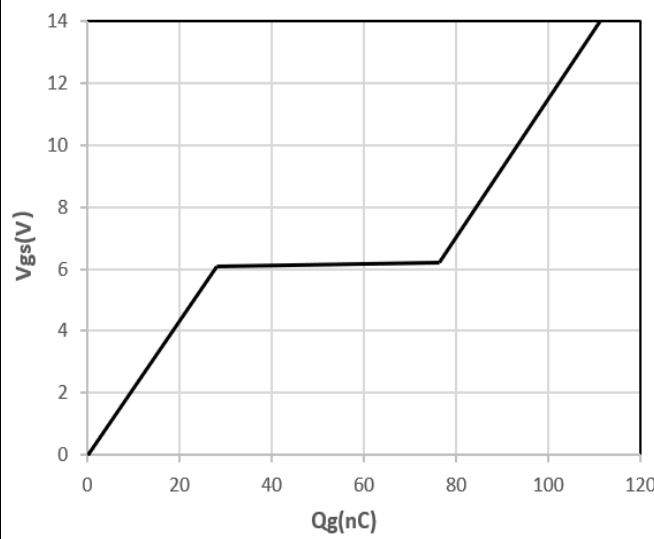
$V_{BR(DSS)}=f(T_J); I_D=10mA$

Diagram 8: Typ. Threshold voltage



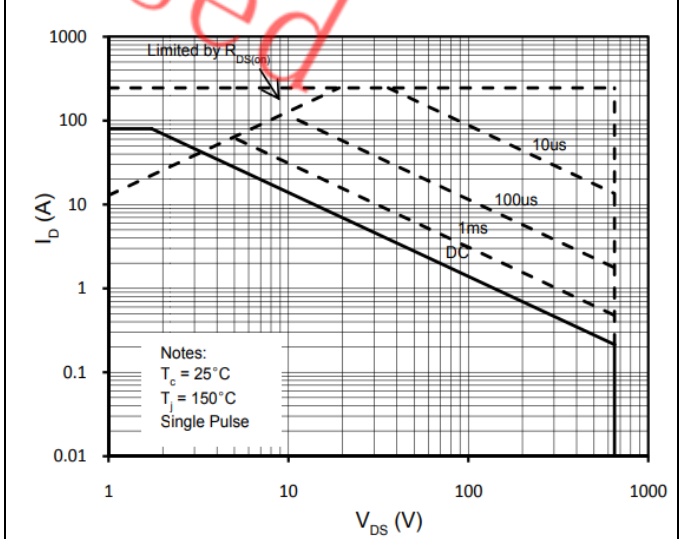
$V_{th}=f(T_C)$

Diagram 9: Typ. Gate charge



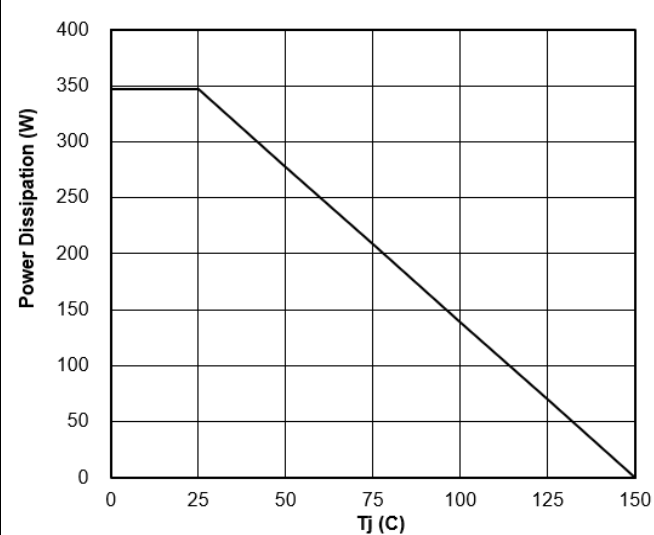
$V_{GS}=f(Q_{gate}); I_D=50A$ pulsed; parameter: V_{DD}

Diagram 10: Typ. Maximum Safe Operating Area



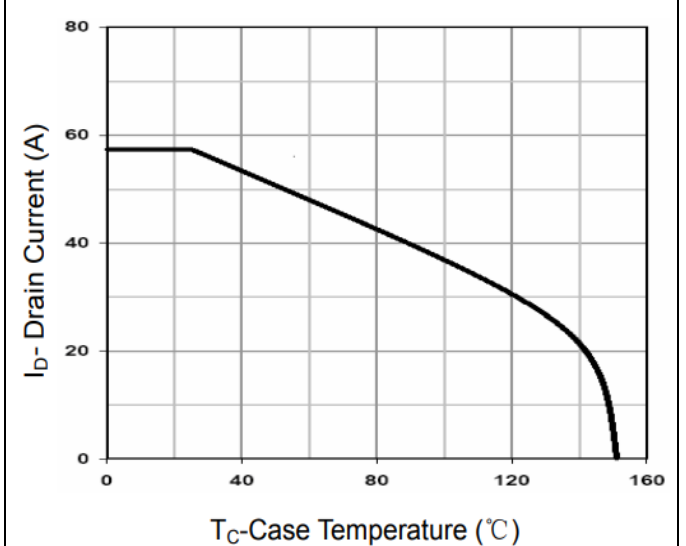
$I_D=f(V_{DS}); T_C=25^\circ C; D=0$; parameter t_p

Diagram 11: Typ. Power Dissipation



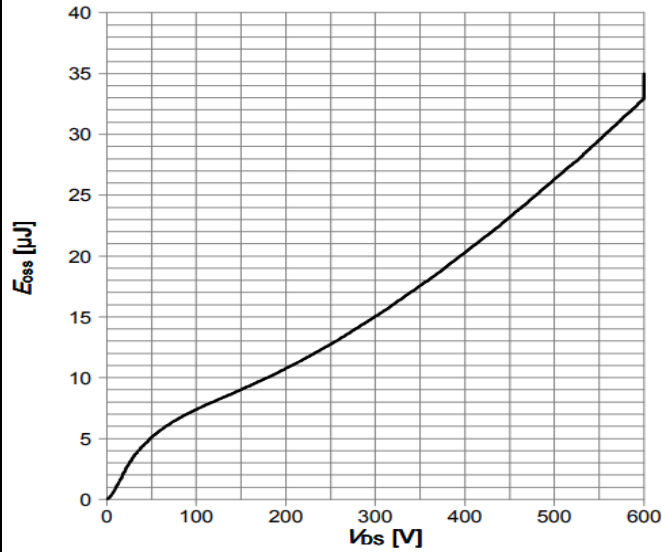
$P_{tot}=f(T_C)$

Diagram 12: Typ. Drain Current De-rating



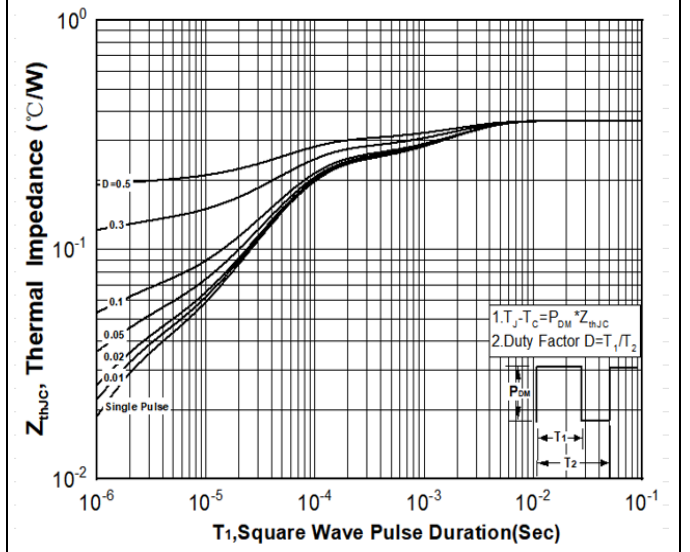
$I_d=f(T_C)$

Diagram 13: Typ. Coss stored energy



$E_{oss} = f(V_{DS})$

Diagram 14: Typ. Max. transient thermal impedance



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

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5 Test Circuits

Table 8 Diode characteristics

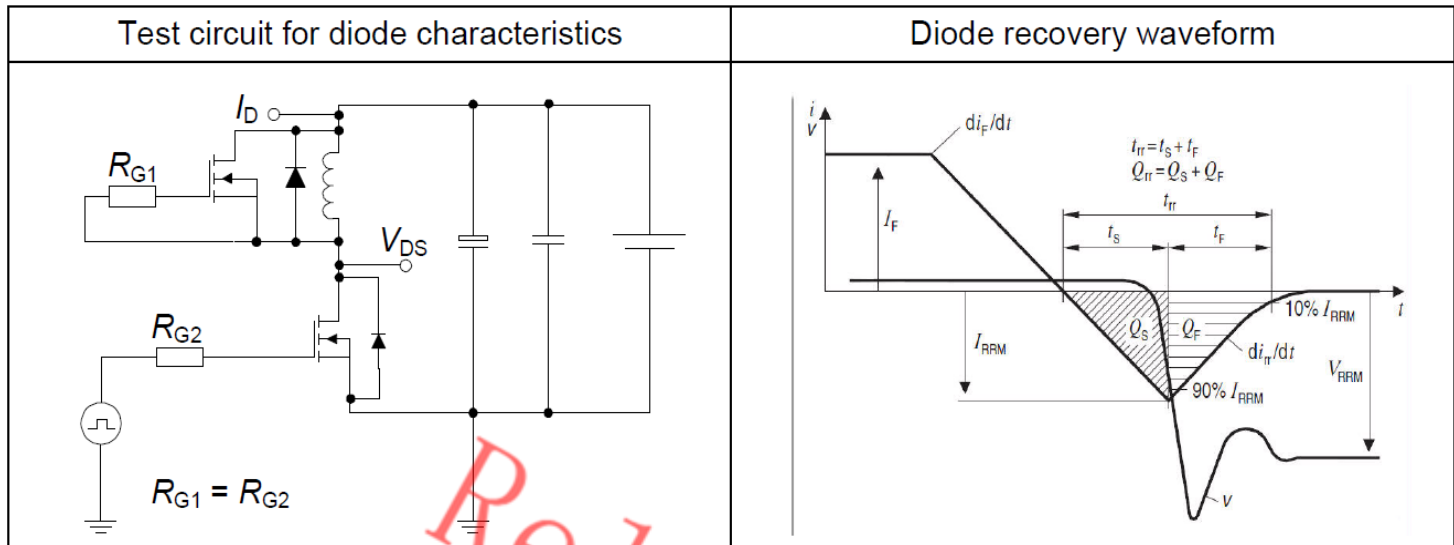


Table 9 Switching times

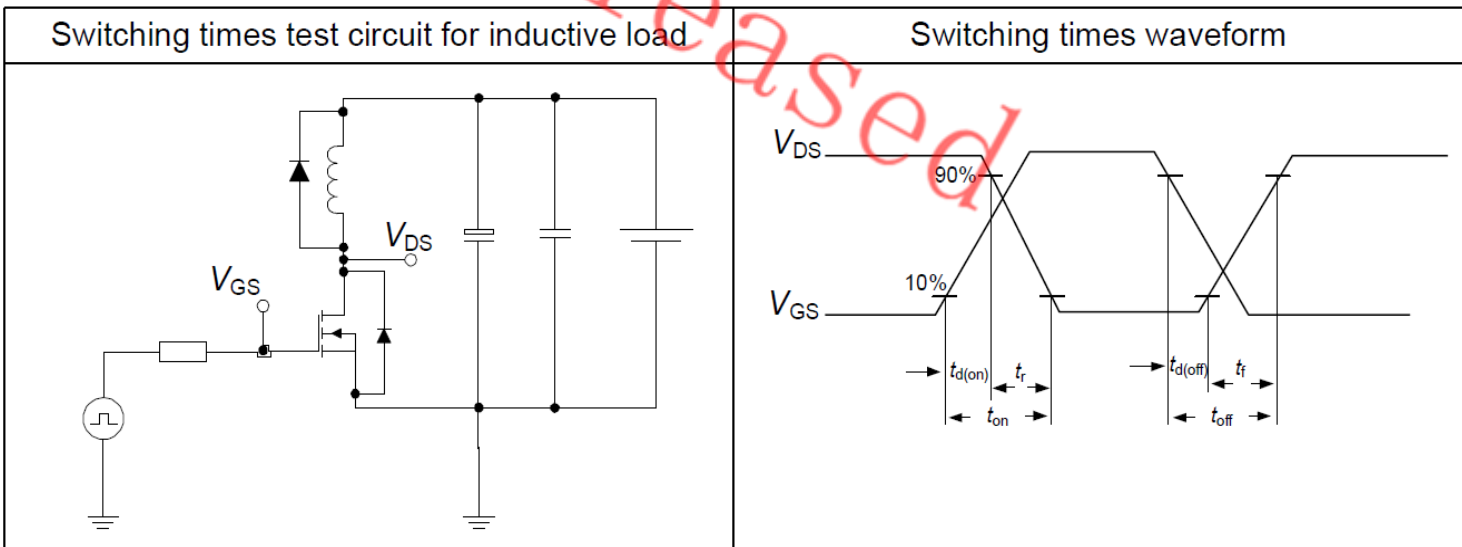
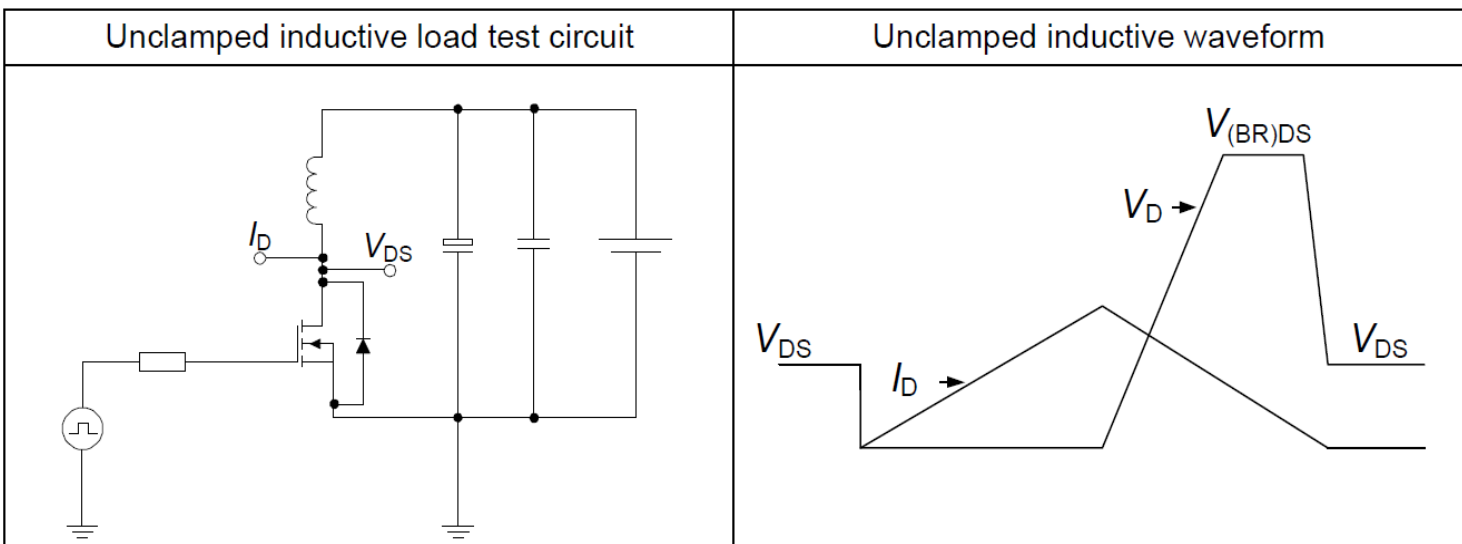
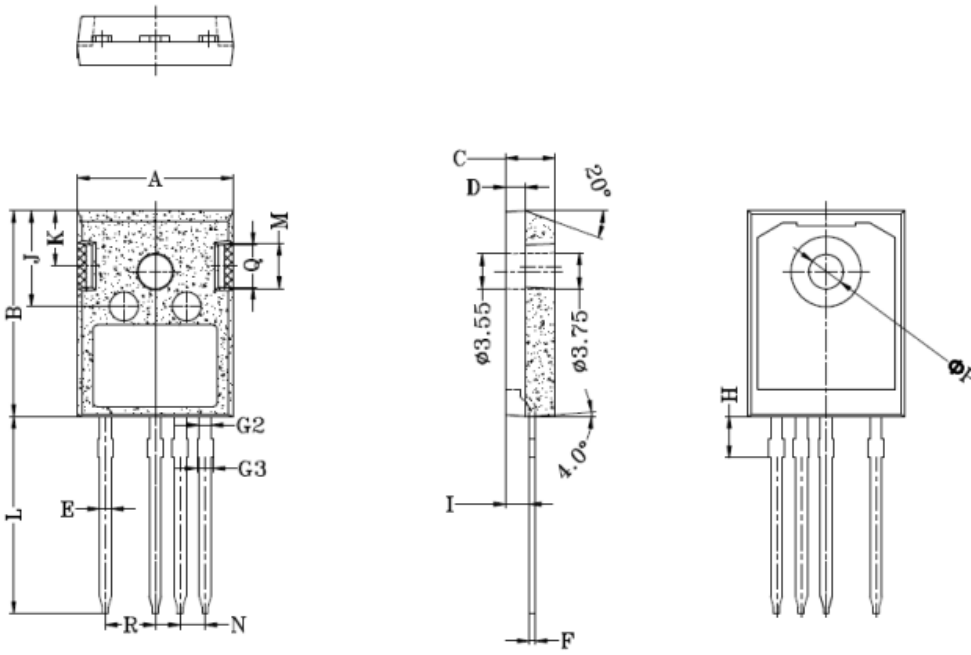


Table 10 Unclamped inductive load

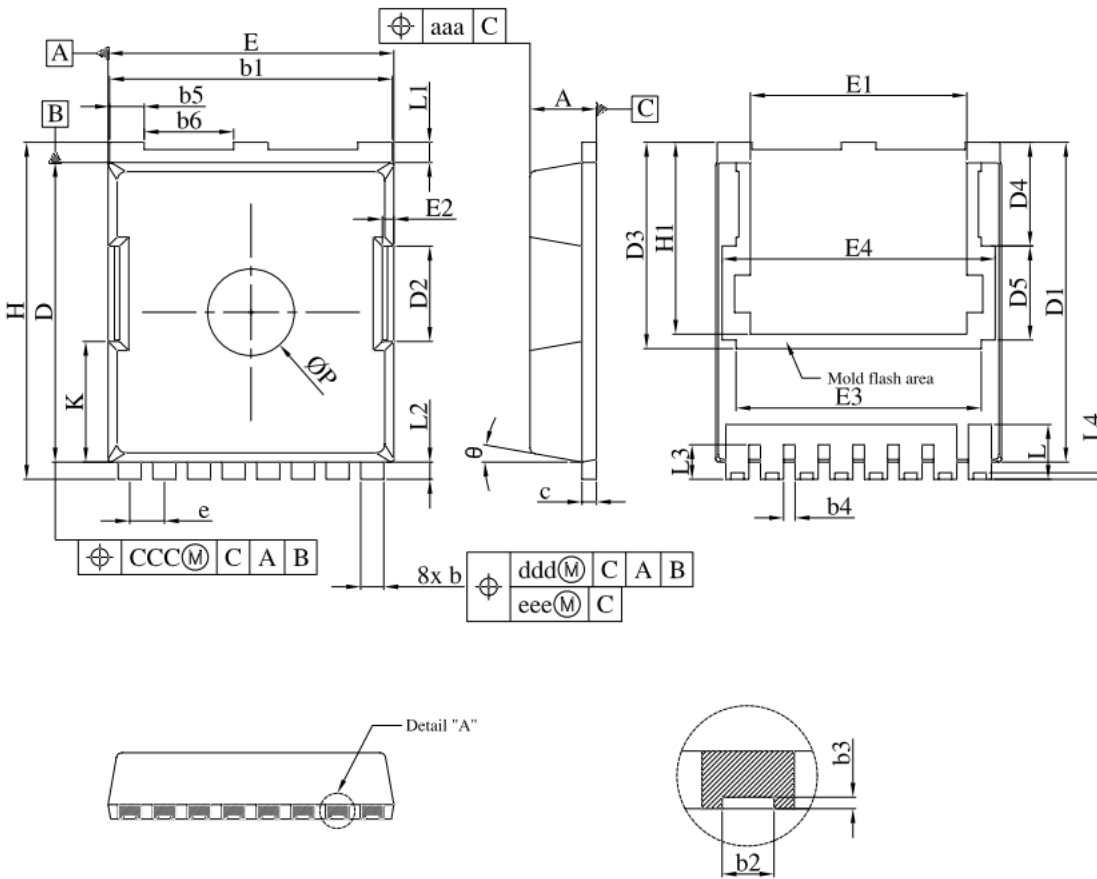




项目	规范(mm)	
	MIN	MAX
A	15.80	16.00
B	20.90	21.10
C	4.90	5.10
D	1.90	2.10
E	1.10	1.30
F	0.50	0.70
G2	1.10	1.30
G3	1.18	1.38
H	4.18	4.38
I	2.30	2.50
J	9.65	9.85
K	5.54	5.74
L	19.80	20.20
M	4.50	4.70
N	2.34	2.74
φ P	3.40	3.60
Q	4.232	4.432
R	4.88	5.28

Outline PG-TO247-4L(HT)

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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
theta	10° REF		
aaa	0.20		
ccc	0.20		
ddd	0.25		
eee	0.20		

Outline PG-TOLL(JQ)

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Revision History

Revision	Date	Subjects (major changes since last revision)
1.0	2023-11-13	Preliminary version
1.1	2023-11-17	Added TOLL package

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