1200V N-Channel Silicon Carbide Power MOSFET (High-tsc)

Features

Low drain-source on-resistance: RDS(ON) = 15mΩ (typ.),$I_{D,pulse}$:280A

Easy to control Gate switching

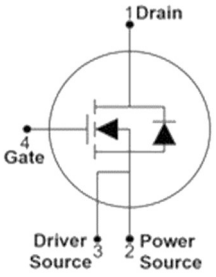
Enhancement mode: Vth = 2 to 4 V

Applications

Solar inverters / PFC / UPS / DC-DC Converter / Welding / EV Charging

MARKING

TO247-4L



YYMM:Date Code(year & month)

XX: Internal Codea

MAXIMUM RATINGS (TC=25°C unless otherwise noted)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	-	-	112	A	TC=25°C
		-	-	80	A	TC=100°C
Avalanche energy, single pulse	E_{AS}	-	-	760	mJ	Tc=25℃,VDD=50V,L=1mH, RG=25Ω
Gate source voltage (static)	V_{GS}	-10	-	25	V	static;
Power dissipation	P_{tot}	-	-	450	W	TC=25°C
Derating factor above 25°C		-	-	3	W/°C	
Storage temperature	T_{stg}	-55	-	175	°C	
Operating junction temperature	T_j	-55	-	175	°C	
Soldering Temperature Distance of 1.6mm from case for 10s	T_L			300	°C	

(1) Limited by Tj,max. Maximum Duty Cycle D = 0.50

(2) Pulse width t_p limited by Tj,max

(3) Identical low side and high side switch with identical R_G

Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition	
		Min.	Typ.	Max.			
Thermal resistance, junction - case	R_{thJC}	-	-	0.33	°C/W	-	T0-247
Thermal resistance, junction - ambient	R_{thJA}	-	-	40	°C/W	device on PCB, minimal footprint	

at Tj=25°C, unless otherwise specified

Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	1200	-	-	V	VGS=0V, ID=100uA
Gate threshold voltage	$V_{(GS)th}$	2	2.8	4	V	VDS=VGS, ID=20mA
Zero gate voltage drain current	I_{DSS}	-	-	100	uA	VDS=1200V, VGS=0V
Gate-source leakage current	I_{GSS+}	-	-	100	nA	VGS=20V, VDS=0V
Gate-source leakage current	I_{GSS-}	-	-	-100	nA	VGS=-10V, VDS=0V
Drain-source on-state resistance	$R_{DS(on)}$	-	15	20	mΩ	VGS=20V, ID=75A, Tj=25°C
			25			VGS=20V, ID=75A, Tj=175°C
Gate resistance (Intrinsic)	R_G	-	2.4	-	Ω	f=1MHz, open drain

Dynamic characteristics

Parameter	**Symbol**	**Values**			**Unit**	**Note / Test Condition**
		Min.	**Typ.**	**Max.**		
Input capacitance	C_{iss}	-	4260	-	pF	V_{GS}=0V, V_{DS}=800V, f=1MHz
Output capacitance	C_{oss}	-	255	-	pF	VGS=0V, VDS=800V, f=1MHz
Reverse transfer capacitance	C_{rss}	-	28	-	pF	VGS=0V, VDS=800V, f=1MHz
Turn-on delay time	$t_{d(on)}$	-	20	-	ns	V_{DD}=800V,V_{GS}=-3.5/18V,I_D=75A RG=2Ω; L=0.1mH T_J =25℃
Rise time	t_r	-	16	-	ns	V_{DD}=800V,V_{GS}=-3.5/18V,I_D=75A RG=2Ω; L=0.1mH T_J =25℃
Turn-off delay time	$t_{d(off)}$	-	46	-	ns	V_{DD}=800V,V_{GS}=-3.5/18V,I_D=75A RG=2Ω; L=0.1mH T_J =25℃
Fall time	t_f	-	20	-	ns	V_{DD}=800V,V_{GS}=-3.5/18V,I_D=75A RG=2Ω; L=0.1mH T_J =25℃
Turn-on Switching Energy	Eon		0.825		mJ	V_{DD}=800V,V_{GS}=-3.5/18V,I_D=75A RG=2Ω; L=0.1mH T_J =25℃
Turn-off Switching Energy	Eoff		0.895		mJ	V_{DD}=800V,V_{GS}=-3.5/18V,I_D=75A RG=2Ω; L=0.1mH T_J =25℃

Gate charge characteristics

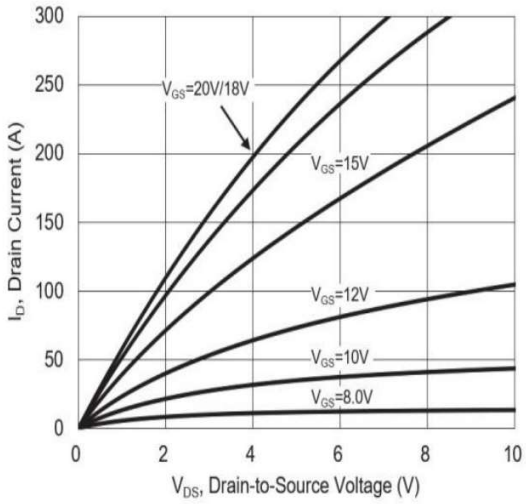
Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	48	-	nC	V_{DD} =800V, I_D =75A, V_{GS} =0/20V
Gate to drain charge	Q_{gd}	-	75	-	nC	V_{DD} =800V, I_D =75A, V_{GS} =0/20V
Gate charge total	Q_g	-	211	-	nC	V_{DD} =800V, I_D =75A, V_{GS} =0/20V

Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	-	3.6	-	V	I_S = 35A, V_{GS} = 0V, Tj=25°C
Continuous Source Curren	I_{SD}	-	-	112	A	
Reverse recovery time	t_{rr}	-	22	-	ns	I_D =75A, V_{GS} =0V di/dt=1000A/us
Reverse recovery charge	Q_{rr}	-	160	-	uC	
Peak reverse recovery current	I_{rrm}	-	10.7	-	A	

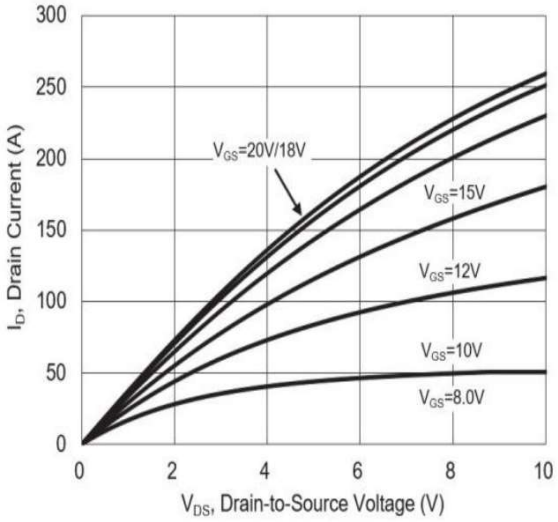
Electrical characteristics diagram

Diagram 1: Typ. output characteristics



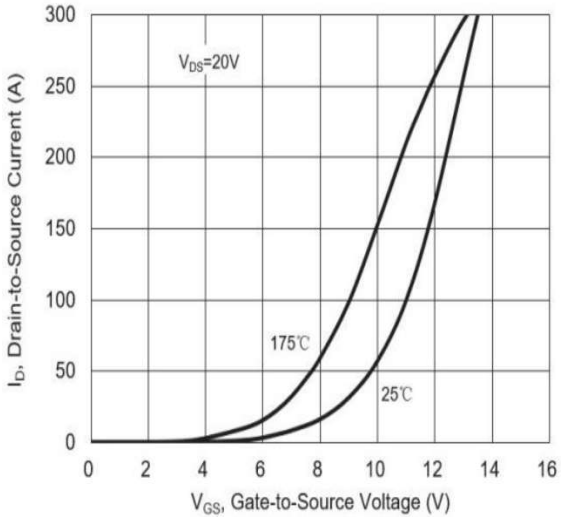
$I_D=f(V_{DS});T_j=25°C$; parameter: V_{GS}

Diagram 2: Typ. output characteristics



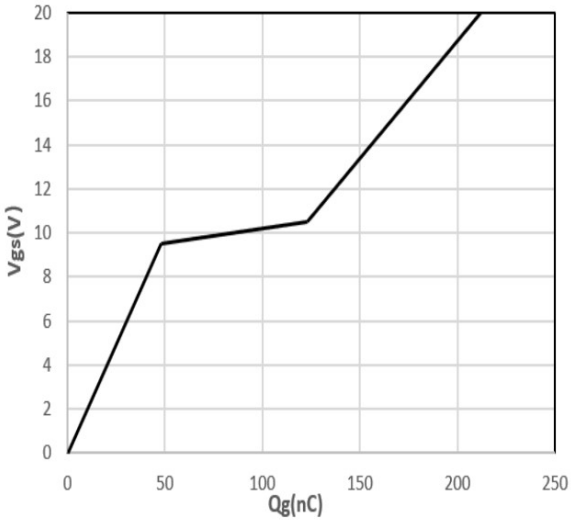
$I_D=f(V_{DS});T_j=175°C$; parameter: V_{GS}

Diagram 3: Typ. transfer characteristics



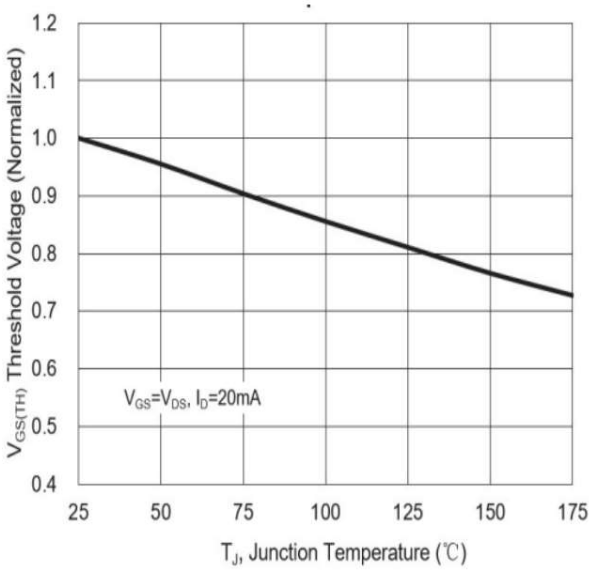
$I_D=f(V_{GS})$; V_{DS} =20V; parameter: T_j

Diagram 4: Typ. gate charge



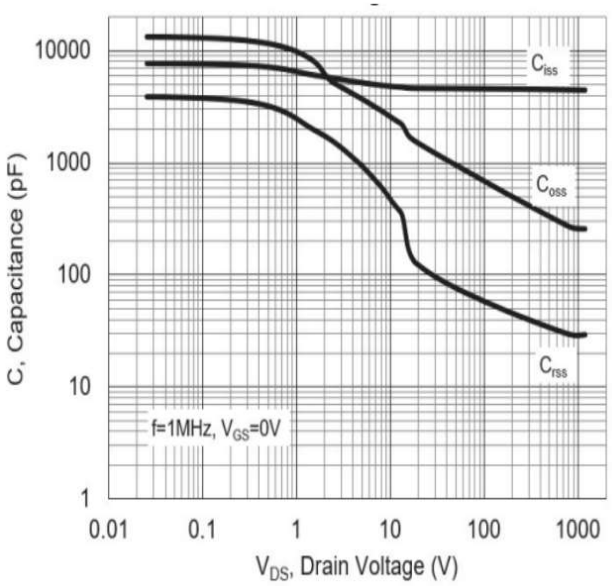
$V_{GS}=f(Q_{gate})$;I_D=75A; V_{DS} = 800V; turn-on pulse

Diagram 5: Typical gate-source threshold voltage as a function of junction temperature



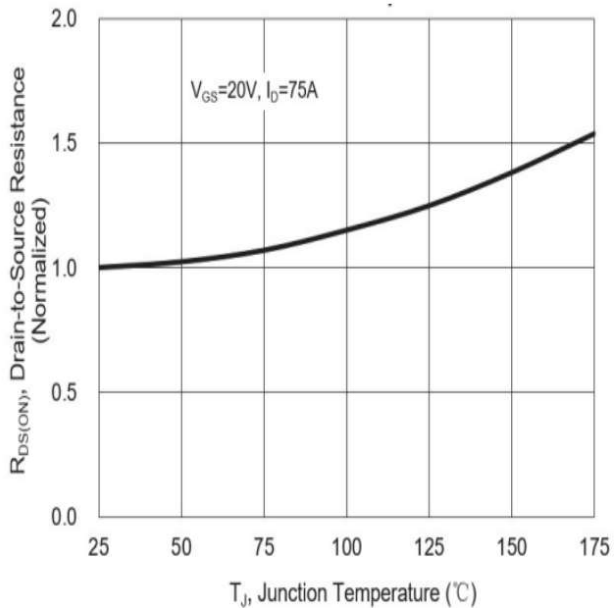
$V_{GS(th)}$=f(T_j); I_{DS}=20mA; V_{GS}=V_{DS}

Diagram 6: Typ. Capacitance as a function of drain-source voltage



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

Diagram 7: Normalized on-resistance as a function of junction temperature



$R_{DS(ON)}$=f(Tj);I_{DS}=75A

Diagram 8: Maximum Peak Current Capabilit

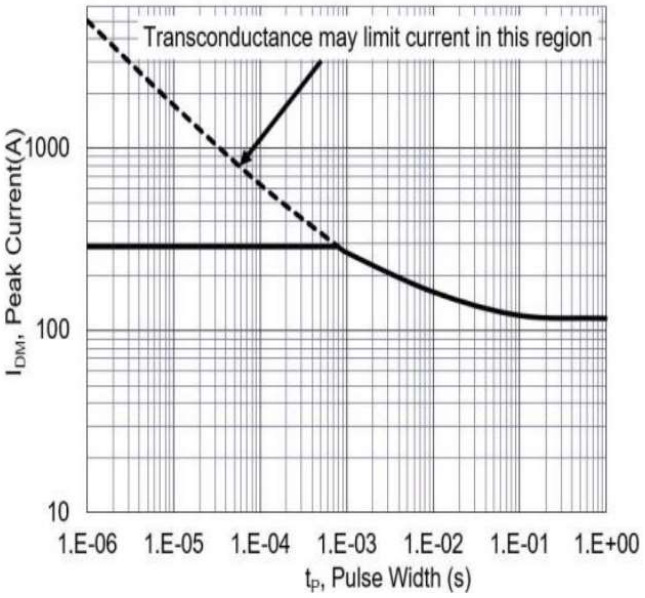
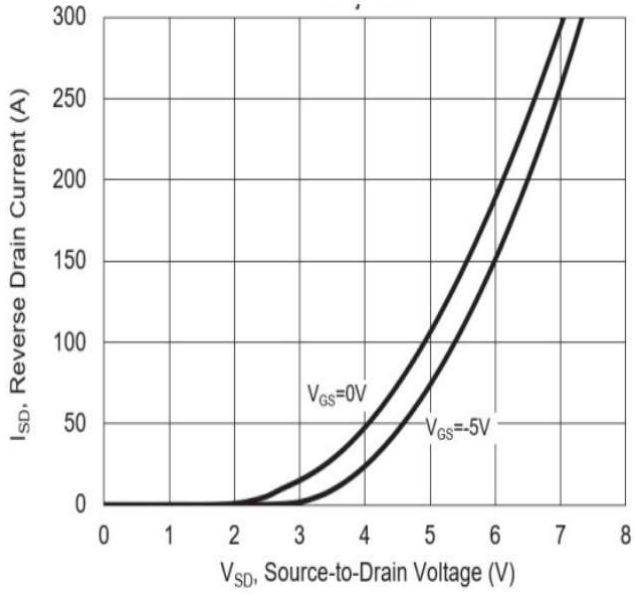
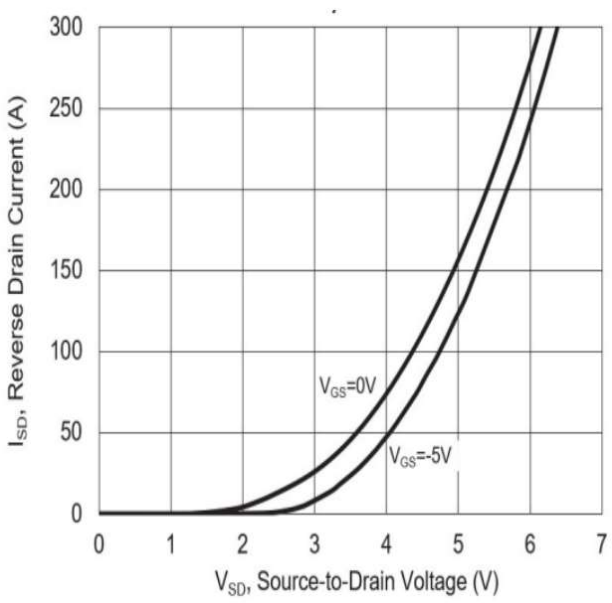


Diagram 9: Typical body diodes forward current as function of forward voltage, V_{GS} as parameter



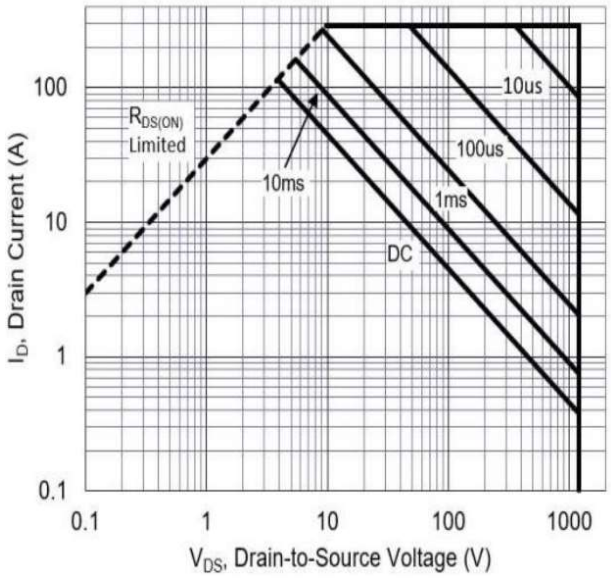
$I_{SD}=f(V_{SD});T_j=25\ °C$

Diagram 10: Typical body diodes forward current as function of forward voltage, V_{GS} as parameter



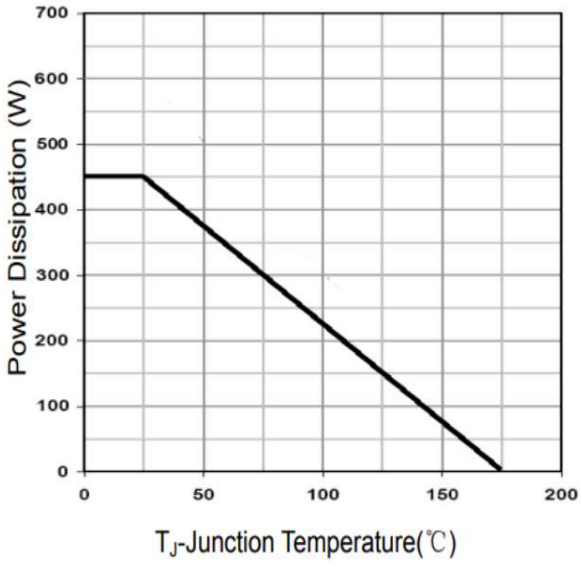
$I_{SD}=f(V_{SD});T_j=175\ °C$

Diagram 11: Safe operating area(SOA)



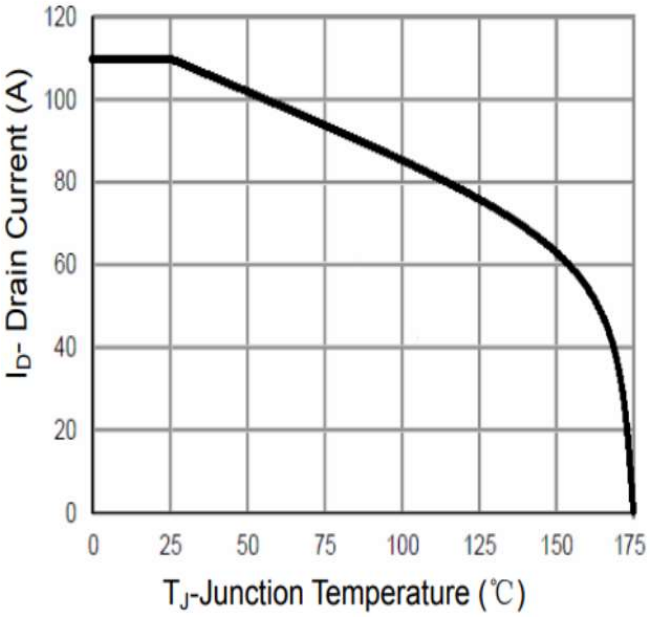
V_{GS}=0/18V; T_C =25 °C; T_j<175 °C

Diagram 12: Power dissipation as a function of case temperature limited by bond wire



$P_{tot}= f(T_C)$

Diagram 13: Maximum DC drain to source current as a function of case temperature limited by bond wire



$I_{DS}=f(T_C)$

Diagram 14: Typical Drain-to-Source ON Resistance vs. Gate Voltage

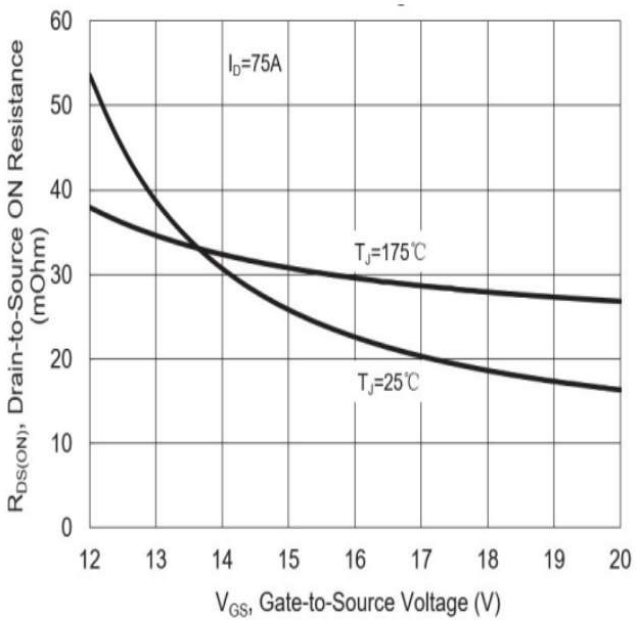
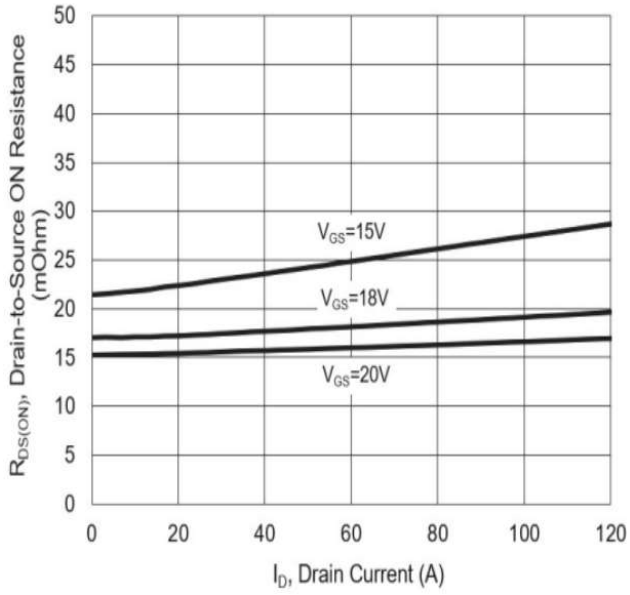
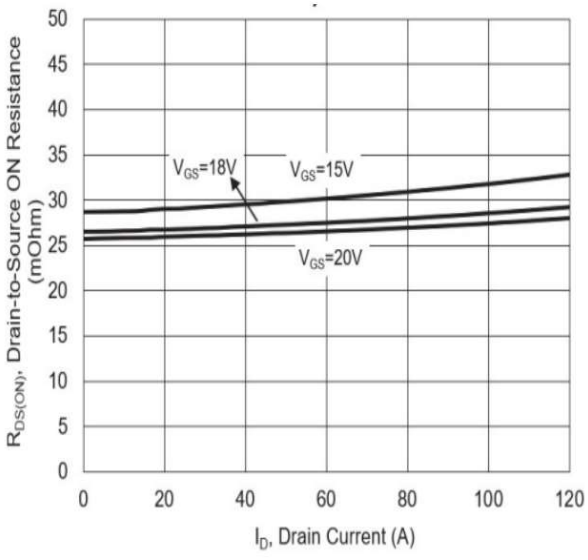


Diagram 15:Typical Drain-to-Source ON Resistance at 25C



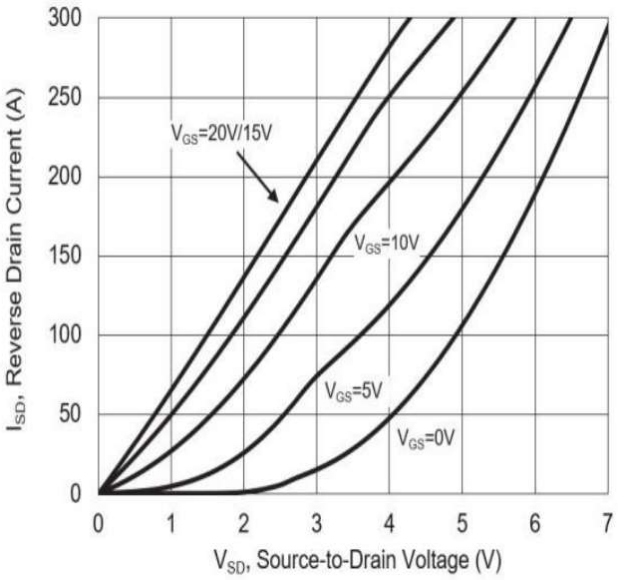
TC=25C

Diagram 16:Typical Drain-to-Source ON Resistance at 175C



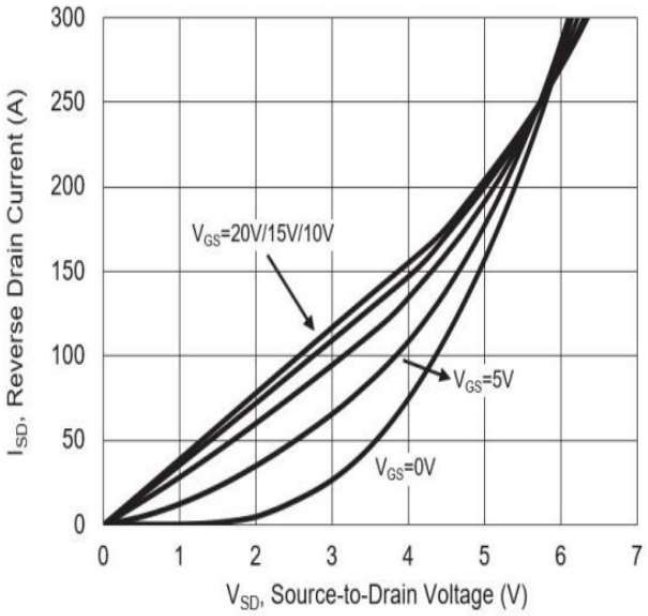
TC=175C

Diagram 17: 3rd Quadrant Characteristics at Tj=25C



TC=25C

Diagram 18: 3rd Quadrant Characteristics at Tj=175C



TC=175C

Diagram 19: Switching Loss vs. Drain Current

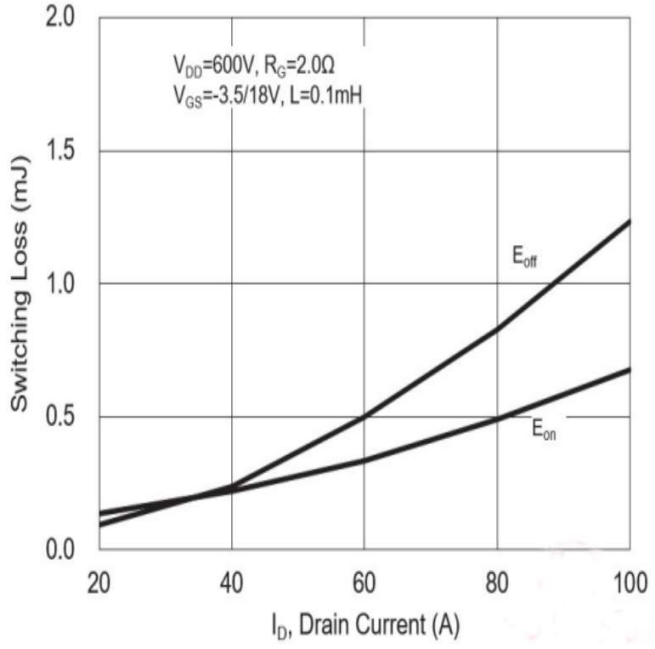


Diagram 20: Switching Loss vs. Drain Current

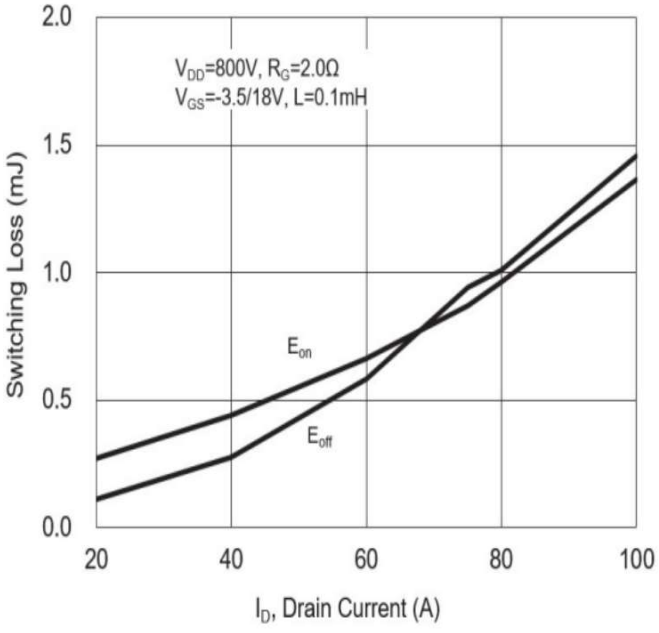


Diagram 21: Switching Times vs. Rg

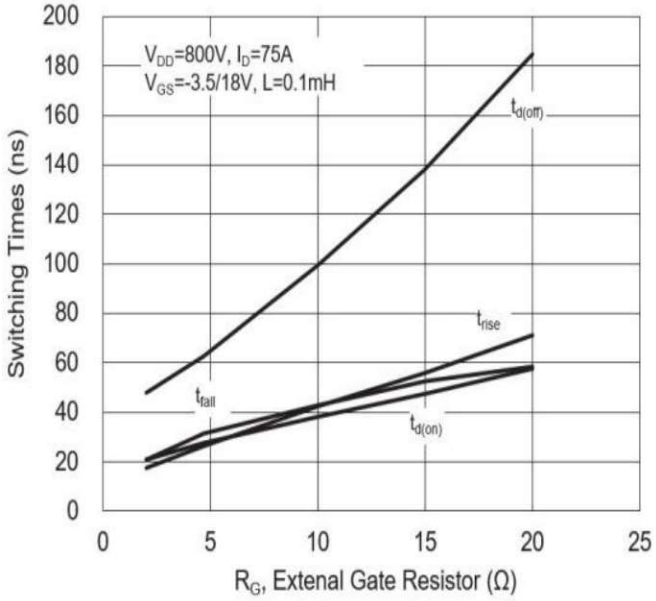


Diagram 22: Switching Times vs. Rg

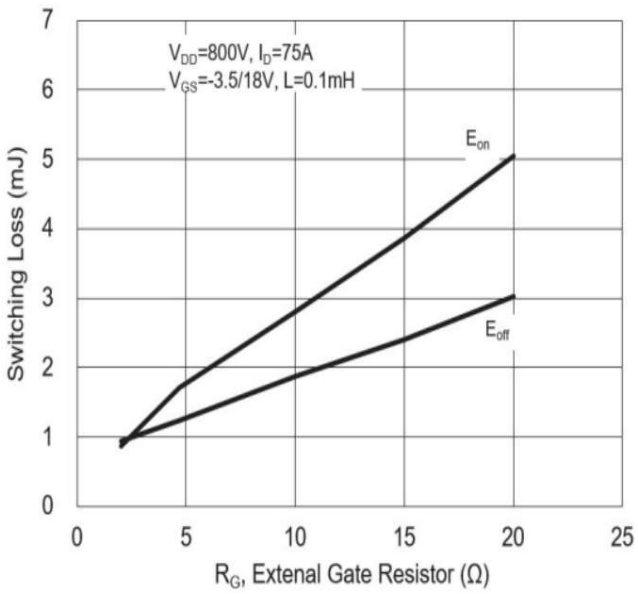
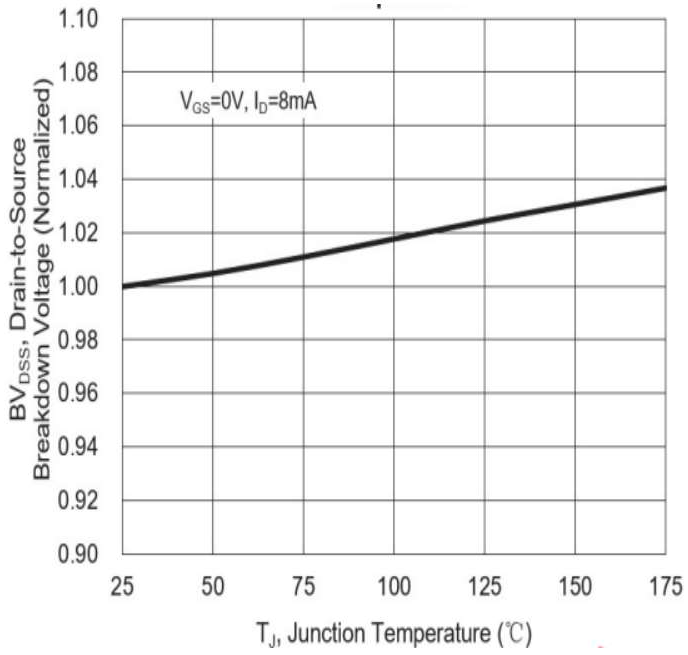
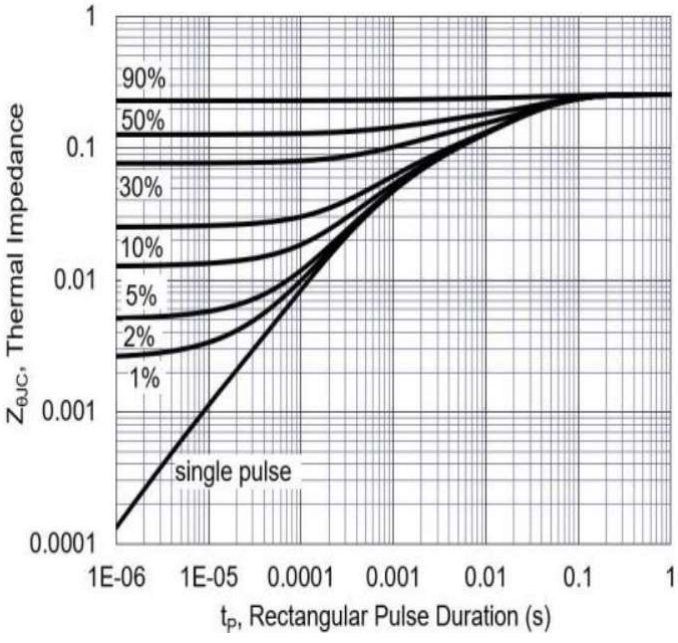


Diagram 23: Typical Breakdown Voltage VS. Junction Temperature



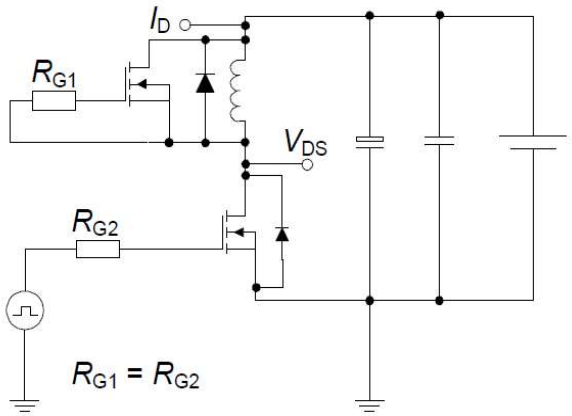
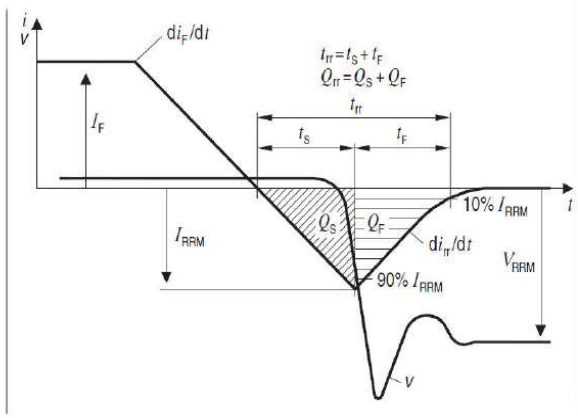
BV_{DSS}= f(T_C)

Diagram 24: Thermal Impedance Junction-to-Case

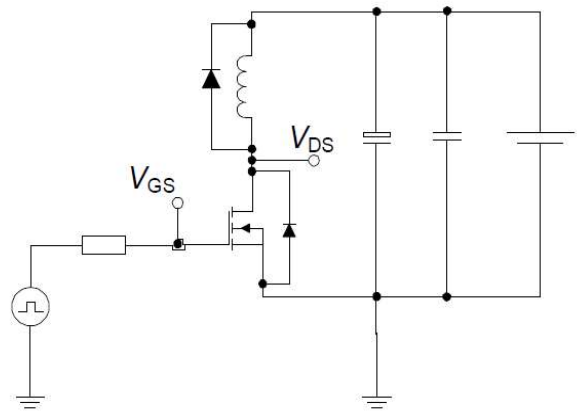
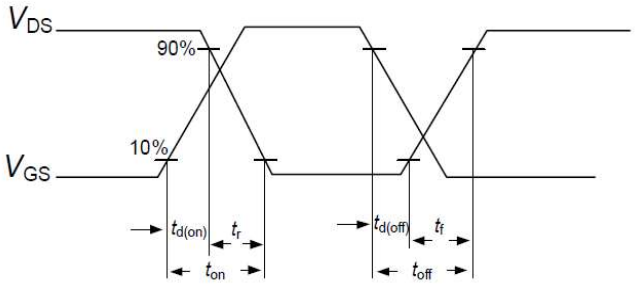


I_{SD}= f(T_C), V_{GS}=0V

Diode characteristics

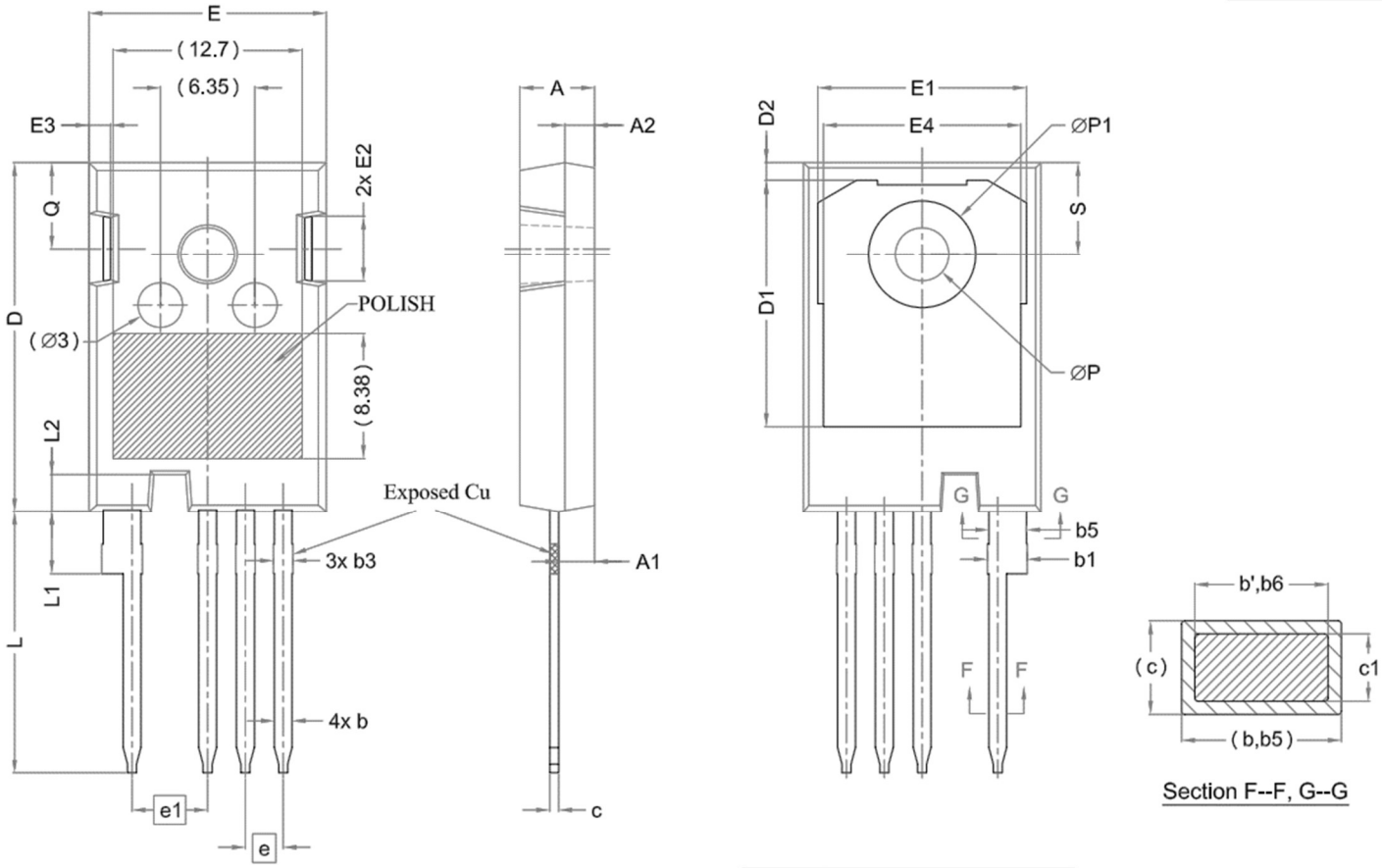
Test circuit for diode characteristics	Diode recovery waveform
	

Switching times

Switching times test circuit for inductive load	Switching times waveform
	

Package Outlines

T0-247-4L



SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	4.83	5.02	5.21
A1	2.29	2.41	2.54
A2	1.91	2.00	2.16
b'	1.07	1.20	1.28
b	1.07	1.20	1.33
b1	2.39	2.67	2.94
b3	1.07	1.30	1.60
b5	2.39	2.53	2.69
b6	2.39	2.53	2.64
c	0.55	0.60	0.68
c1	0.55	0.60	0.65
D	23.30	23.45	23.60
D1	16.25	16.55	17.65
D2	0.95	1.19	1.25
E	15.75	15.94	16.13
E1	13.10	14.02	14.15
E2	3.68	4.40	5.10
E3	1.00	1.45	1.90
E4	12.38	13.26	13.43
e	2.54 BSC		
e1	5.08 BSC		
L	17.31	17.57	17.82
L1	3.97	4.19	4.37
L2	2.35	2.50	2.65
ØP	3.51	3.61	3.65
ØP1	7.19 REF.		
Q	5.49	5.79	6.00
S	6.04	6.17	6.30