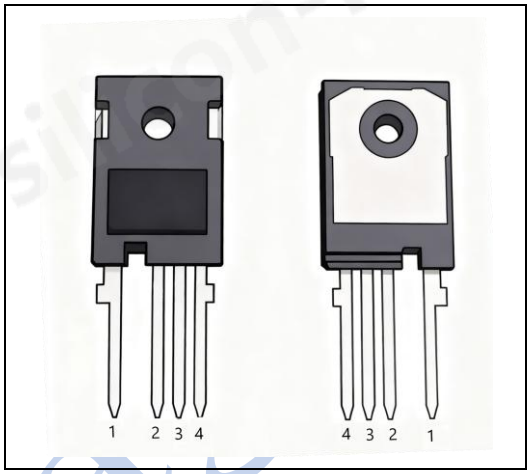
N-Channel Silicon Carbide Power MOSFET

Product summary

V_{DS} (V)	$R_{DS(on),typ}$ (mΩ)	I_D (A)
1200	60 @ V_{GS} = 18 V	44

TO247-4L

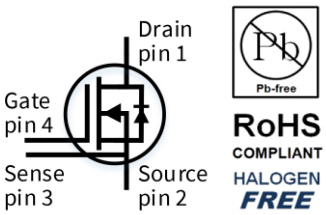


Features

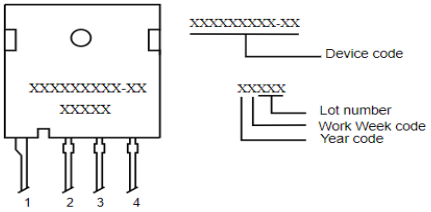
- Silicon carbide material with excellent characteristics
- High blocking voltage with low $R_{DS(on)}$
- Fast switching speed with low capacitance
- Low reverse recovery charge
- High power density, system switching frequency and efficiency.

Applications

- EV battery charger
- High voltage DC/DC converter
- Solar inverters
- Energy storage system



Pb-free
RoHS
COMPLIANT
HALOGEN
FREE



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Package and ordering information

Ordering code	Package	Device code
SCHA2N060JN-AA	TO247-4L	HA2N060JN-AA

1. Maximum ratings

Absolute maximum ratings (T_C = 25℃ unless otherwise specified)				
Parameter		**Symbol**	**Limit**	**Unit**
Drain-source voltage		V_{DS}	1200	V
Gate-source voltage		V_{GSmax}	-10/+22	
Recommended Operation values of Gate-Source voltage		V_{GSop}	-5...-3/+18	V
Continuous drain current(1)	V_{GS}=18 V, T_C=25℃	I_D	44	A
	V_{GS}=18 V, T_C=100℃		32	
Pulsed drain current(2)		$I_{D,pulse}$	110	
Power dissipation	T_C=25℃	P_D	263	W
	T_C=100℃		132	
Operating junction and storage temperature range		T_J, T_{stg}	-55 to 175	℃
Soldering temperature		T_{solder}	260	
Single Pulse Drain−to−Source Avalanche Energy(3)		E_{AS}	128	mJ

2. Thermal resistance ratings

Thermal resistance ratings				
Parameter		**Symbol**	**Max.**	**Unit**
Thermal resistance, junction-to-case	Steady state	$R_{\theta JC}$	0.57	℃/W

3. Electrical Characteristics

Electrical characteristics (T_C = 25 ℃ unless otherwise specified)						
Parameter	**Symbol**	**Test conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Static parameter						
Drain to source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 1 mA	1200			V
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 7.5mA	2.0	3.0	4.5	V
		V_{DS} = V_{GS}, I_D = 7.5 mA, T_J = 175 ℃		1.9		
Gate-body leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = -10/+22 V			±100	nA
Zero gate voltage drain current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V			100	μA
Drain-source on-resistance	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 20 A		60.0	84.0	mΩ
		V_{GS} = 15 V, I_D = 20 A		80.0		
		V_{GS} = 18 V, I_D = 20 A, T_J = 175 ℃		96.0		
Forward transconductance	g_{fs}	V_{DS} = 20 V, I_D = 20 A		13.7		S
		V_{DS} = 20 V, I_D = 20 A, T_J = 175 ℃		13.3		
Gate resistance	R_g	f=1 MHz		3.6		Ω
Dynamic(4)						
Input capacitance	C_{iss}	V_{DS} = 800 V, V_{GS} = 0 V, f = 100 kHz		1098		pF
Output capacitance	C_{oss}			73		
Reverse transfer capacitance	C_{rss}			3		
Total gate charge	Q_g	V_{DS} = 800 V, V_{GS} = -4 V/+18 V, I_D = 20 A		52		nC
Gate-source charge	Q_{gs}			14		
Gate-drain charge	Q_{gd}			23		
Turn-on delay time	$t_{d(on)}$	V_{DS} = 800 V, I_D = 20 A, V_{GS} = -4 V/+18 V, R_{GEN} = 4.7 Ω, L = 1 mH, $L_σ$=40 nH, Timing relative to VDS, Inductive load		9		ns
Rise time	t_r			14		
Turn-off delay time	$t_{d(off)}$			17		
Fall time	t_f			8		
Turn-On Switching Energy (SiC Diode FWD)	E_{on}	V_{DS} = 800 V, V_{GS} = -4 V/+18 V, I_D = 20 A, R_{GEN} = 4.7 Ω, L= 1 mH, $L_σ$=40 nH, T_J = 25 ℃		133		μJ
Turn Off Switching Energy (SiC Diode FWD)	E_{off}			50		
Reverse Diode Characteristics						
Diode forward voltage	V_{SD}	V_{GS} =-3 V, I_F = 20 A		4.3		V
		V_{GS} =-3 V, I_F = 20 A, T_J = 175 ℃		3.7		
Reverse recovery time	t_{rr}	V_{GS} =-3 V, V_{DS} = 800 V, I_F = 20 A, di/dt = 3000 A/μs, T_J = 25 ℃		13		ns
Reverse recovery charge	Q_{rr}			145		nC
Peak reverse recovery current	I_{rrm}			18		A

Notes

(1) Package limited.

(2) Pulse width limited by maximum junction temperature.

(3) EAS of 128 mJ is based on starting TJ = 25°C; L = 1 mH.

(4) Guaranteed by design, not subject to production testing.

4. Electrical characteristics diagrams

Fig.1 Typ. output characteristics at -55℃

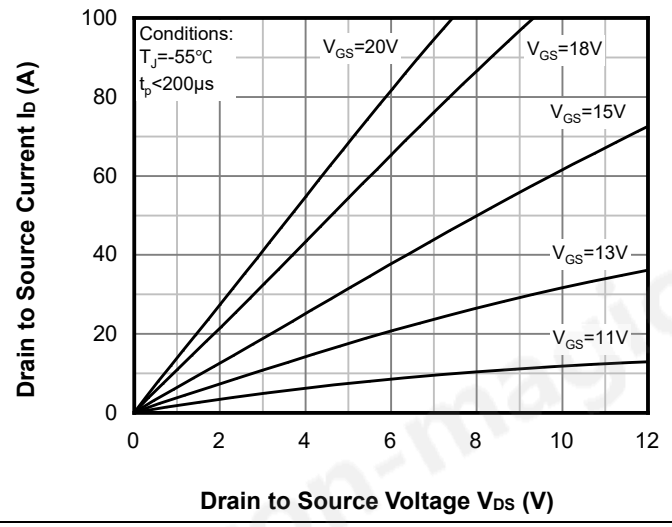


Fig.2 Typ. output characteristics at 25℃

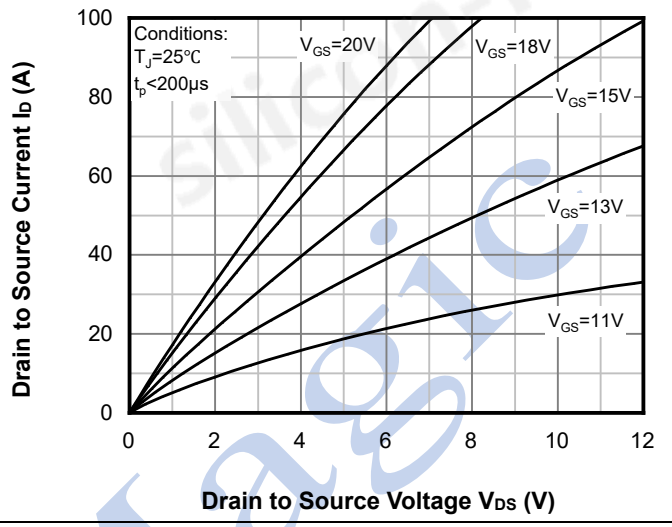


Fig.3 Typ. output characteristics at 175℃

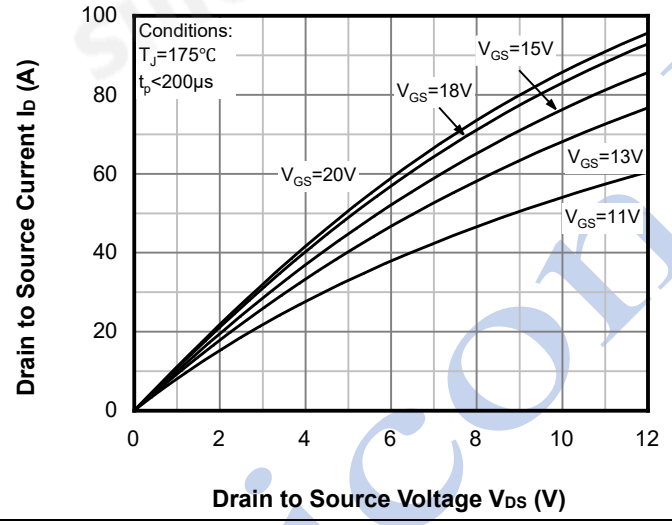


Fig.4 Normalized on-resistance vs junction temperature

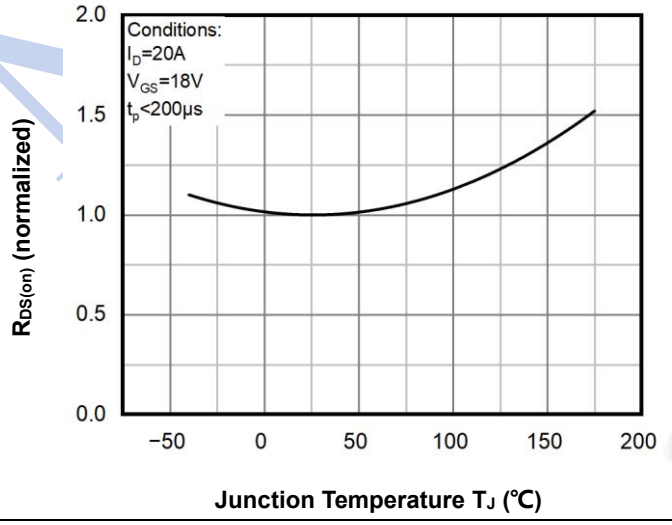


Fig.5 Typ. on-resistance vs drain current

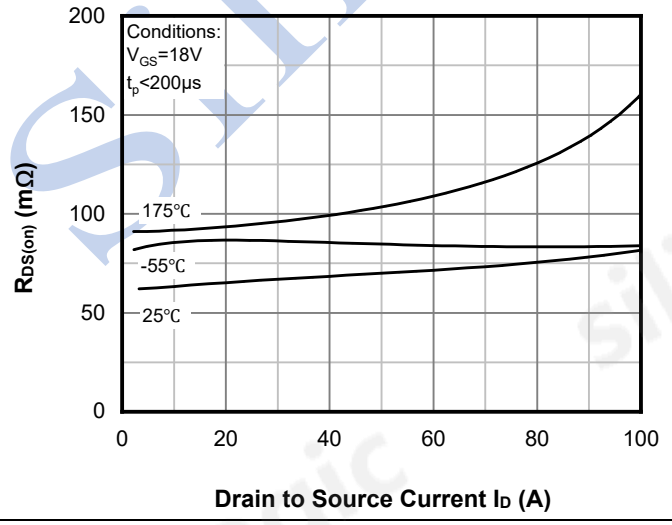


Fig.6 Typ. transfer characteristics

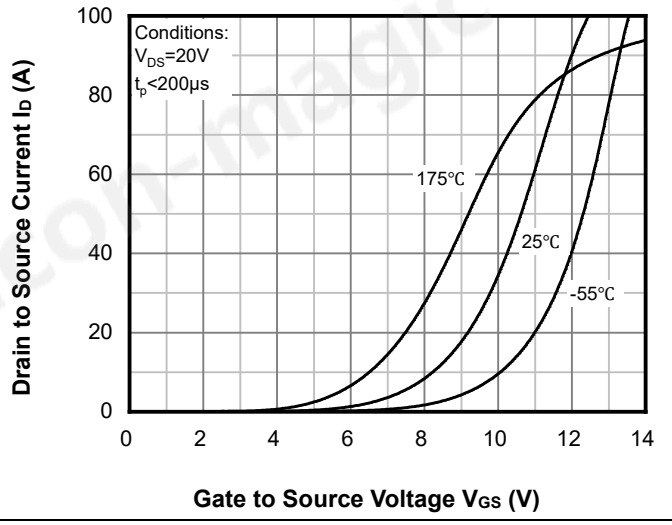


Fig.7 Typ. forward characteristics of body diode at -55℃

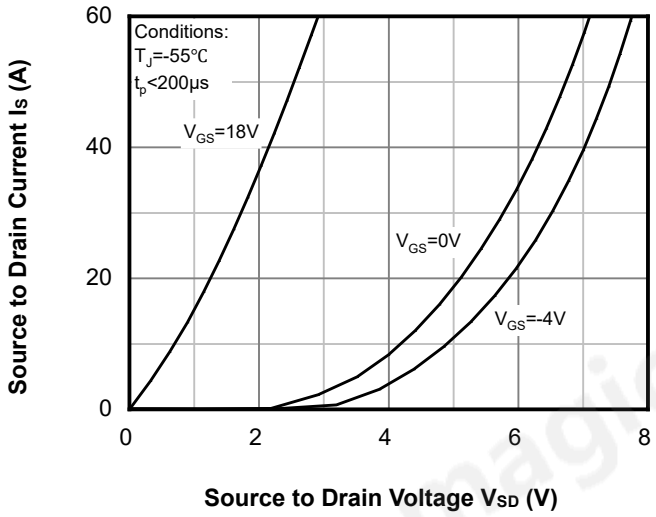


Fig.8 Typ. forward characteristics of body diode at 25℃

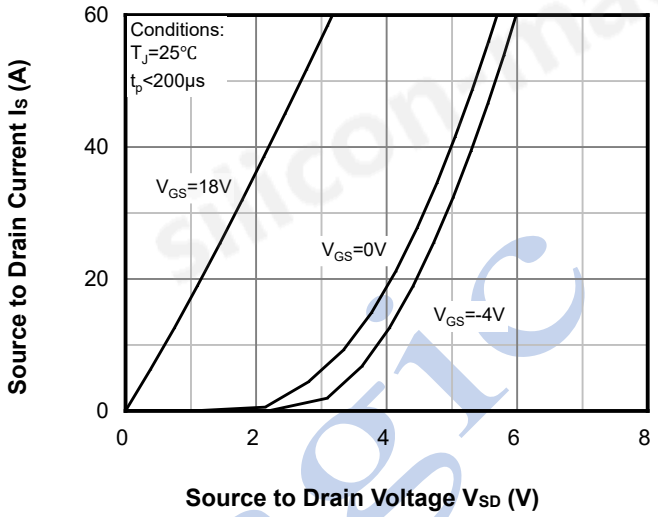


Fig.9 Typ. forward characteristics of body diode at 175℃

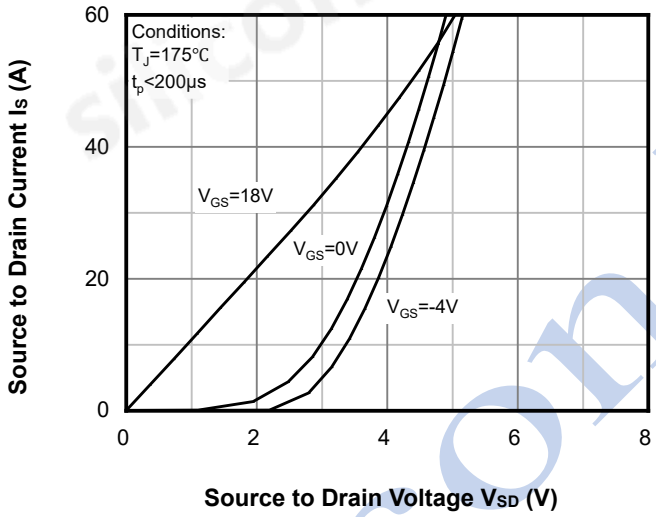


Fig.10 Typ. threshold voltage vs junction temperature

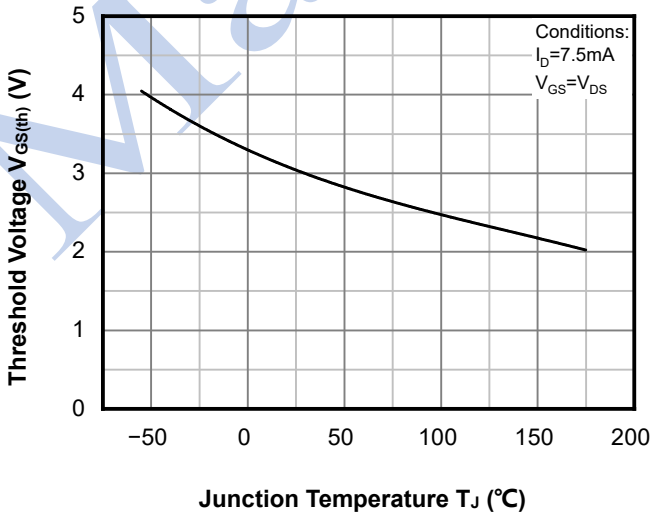


Fig.11 Typ. gate charge

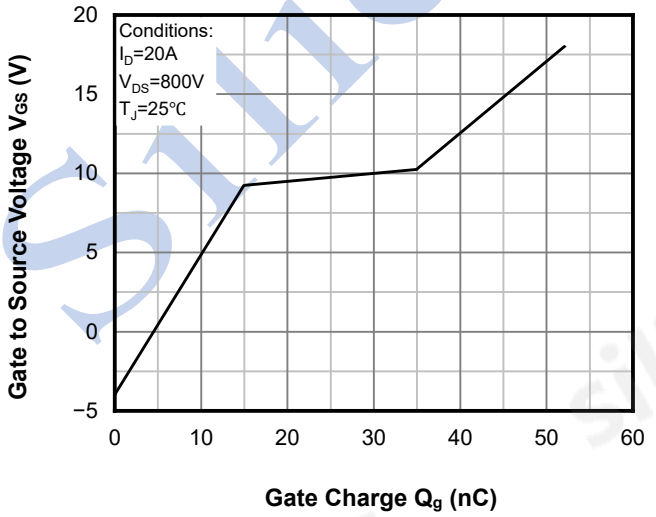


Fig.12 Typ. 3rd quadrant characteristics at -55℃

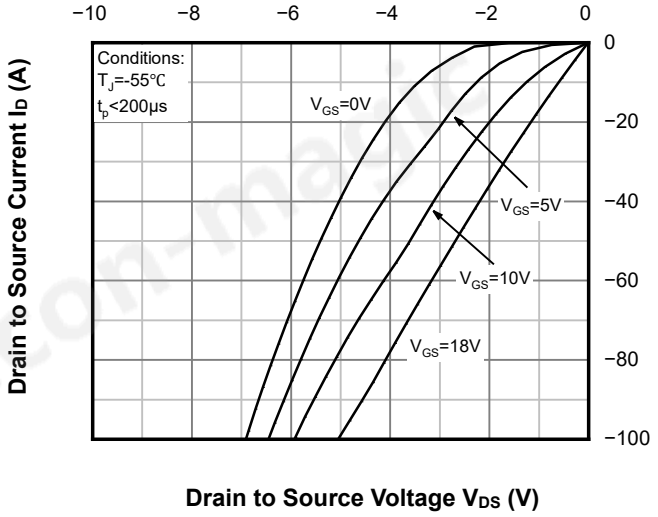


Fig.13 Typ. 3rd quadrant characteristics at 25℃

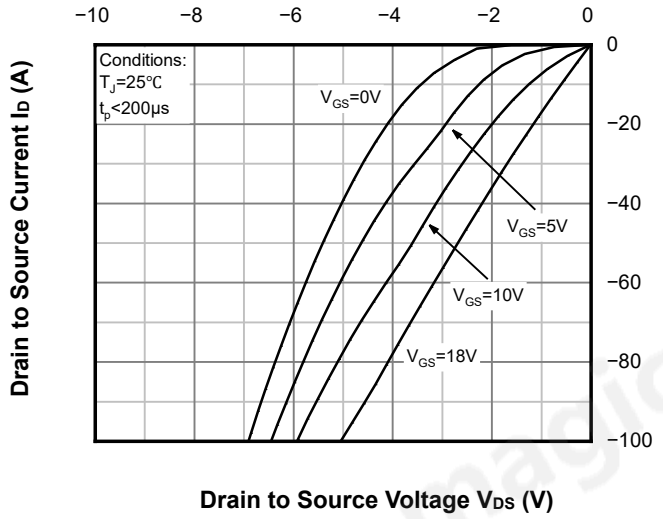


Fig.14 Typ. 3rd quadrant characteristics at 175℃

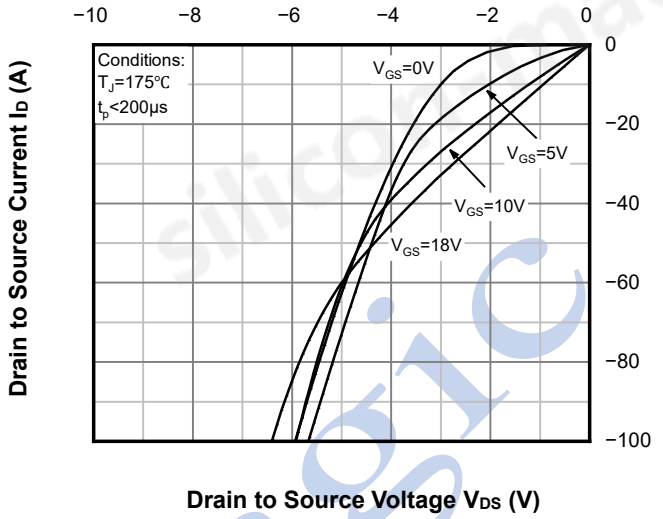


Fig.15 Typ. Capacitance (0~200V)

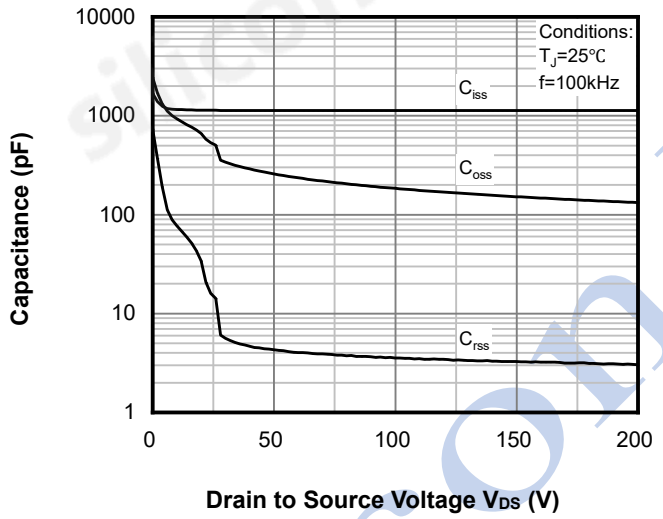


Fig.16 Typ. Capacitance (0~1200V)

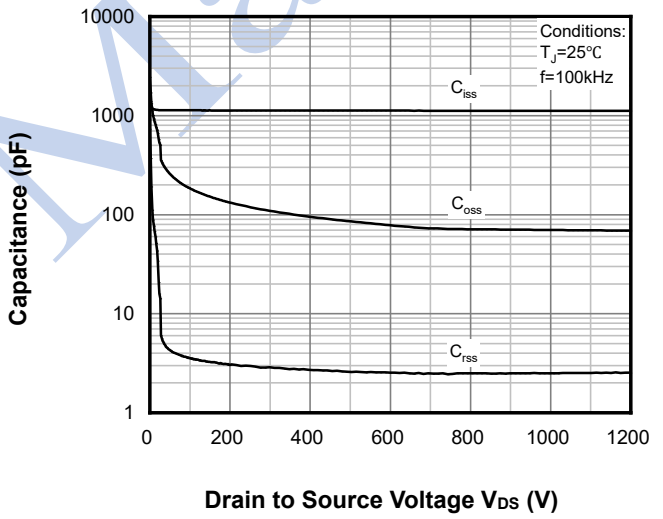


Fig.17 Safe operating area

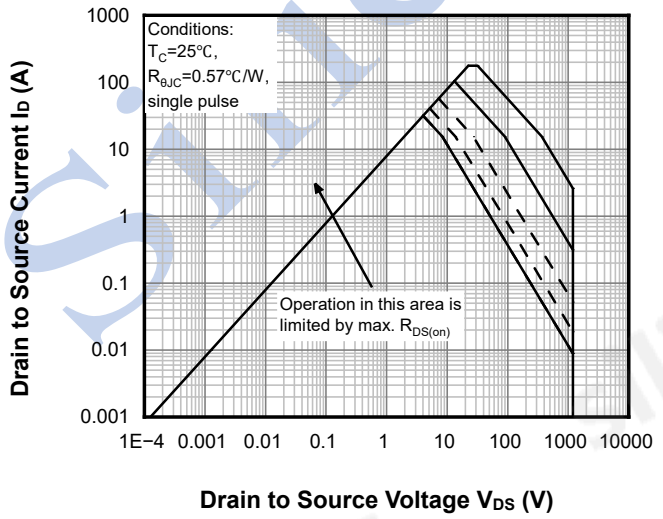


Fig.18 Max. power dissipation vs case temperature

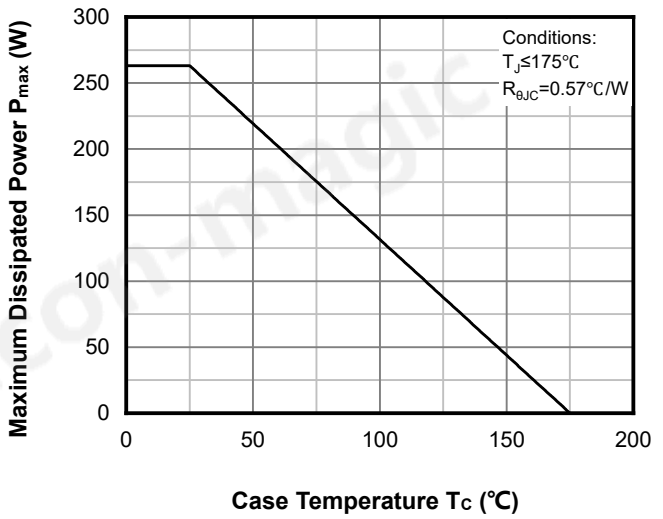


Fig.19 Max. continuous drain current vs. case temperature

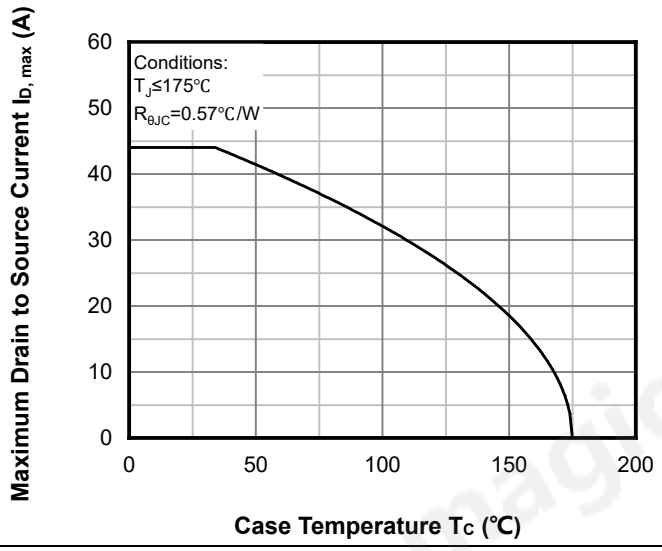


Fig.20 Clamped Inductive Switching Energy vs temperature

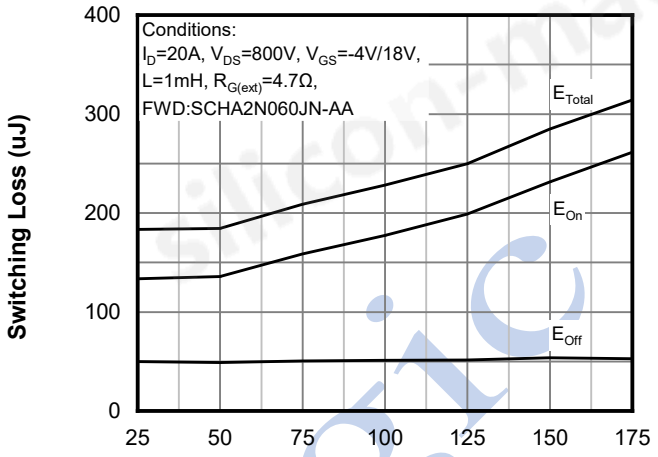


Fig.21 Clamped Inductive Switching Energy vs Drain Current

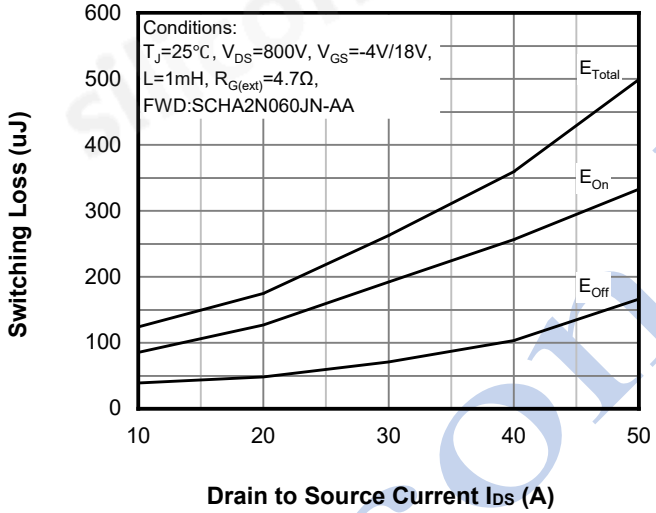


Fig.22 Clamped Inductive Switching Energy vs $R_{G(ext)}$

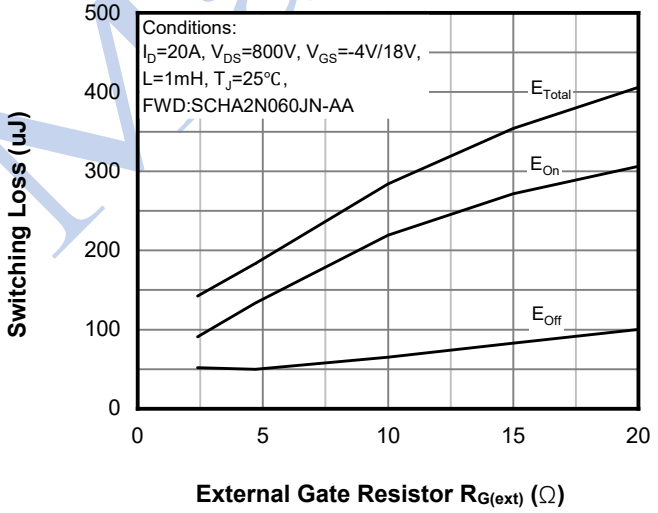
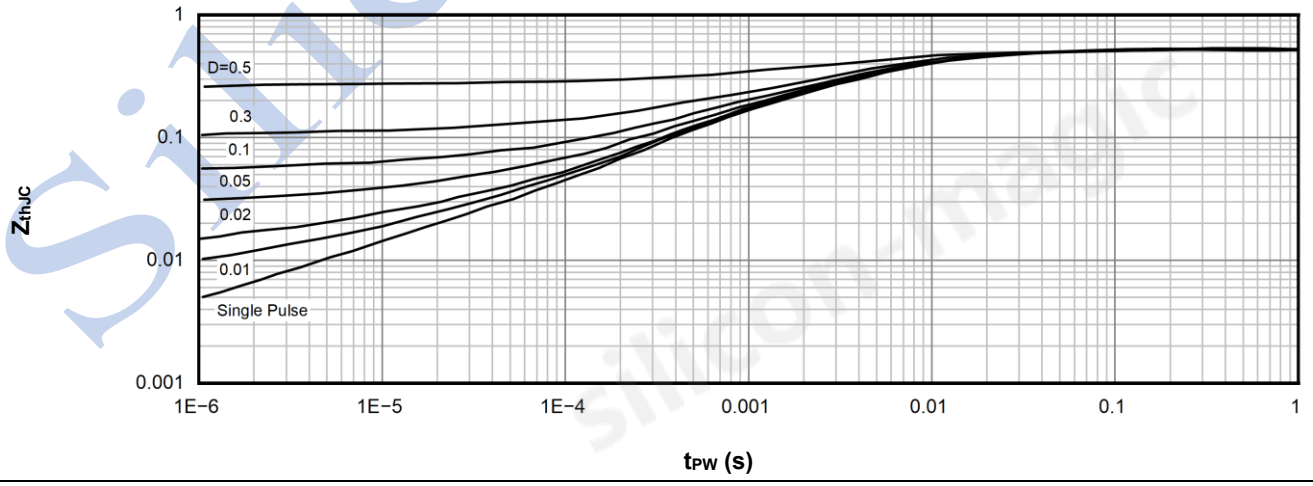
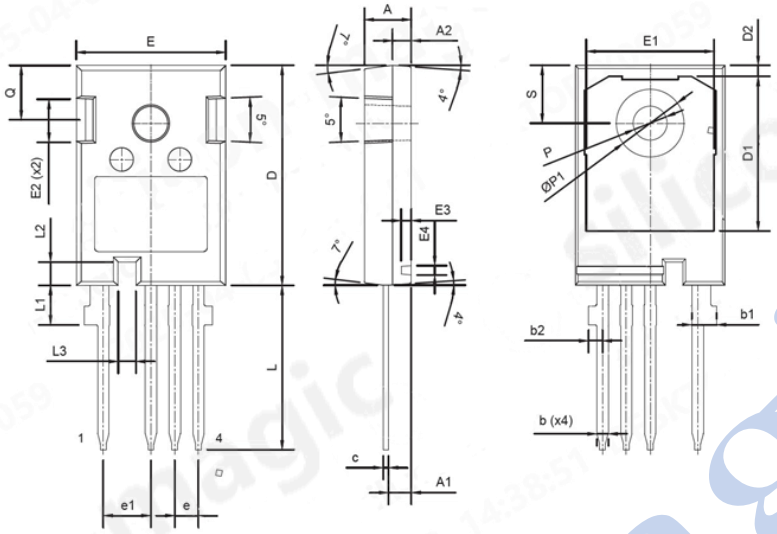


Fig.23 Transient thermal impedance from junction to case



5. Package outline dimensions



Dim	Millimeters		
	Min	Nom	Max
A	4.82	5.02	5.22
A1	2.29	2.42	2.54
A2	1.90	2.00	2.10
b	1.10	1.20	1.30
b1	2.52	2.67	2.81
b2	1.40	1.50	1.60
c	0.50	0.60	0.70
D	23.35	23.45	23.55
D1	16.26	16.46	16.66
D2	0.99	1.19	1.39
E	15.75	15.94	16.13
E1	13.46	13.66	13.86
E2	4.32	4.58	4.78
E3	1.05	1.10	1.25
E4	0.95	1.00	1.15
e	2.54 BSC		
e1	5.08 BSC		
L	17.37	17.57	17.72
L1	3.97	4.19	4.41
L2	2.35	2.50	2.65
L3	1.73	1.88	2.03
P	3.56	3.61	3.66
P1	7.15	7.20	7.25
Q	5.49	5.79	6.09
S	6.17 BSC		

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