

N-Channel Silicon Carbide Power MOSFET

Product summary

V_{DS} (V)	$R_{DS(on),typ}$ (m Ω)	I_D (A)
1200	40 @ $V_{GS} = 18$ V	57

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

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Package and ordering information

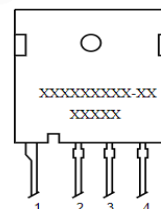
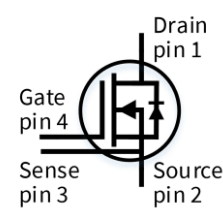
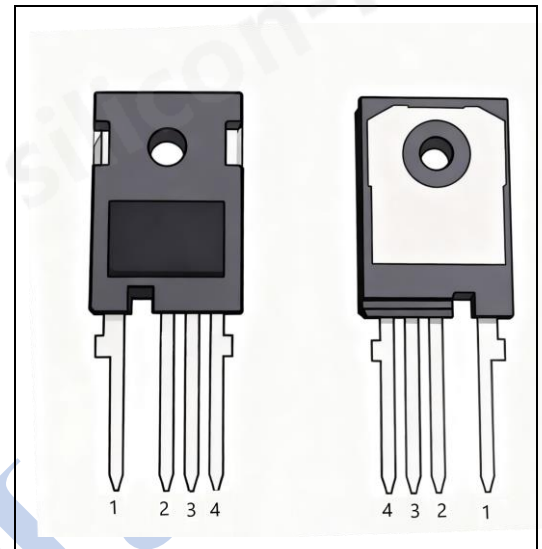
Ordering code	Package	Device code
SCHA2N040JN-AA	TO247-4L	HA2N040JN-AA

1. Maximum ratings

Absolute maximum ratings ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Limit	Unit
Drain-source voltage	V_{DS}	1200	V
Gate-source voltage	V_{GSmax}	-10/+22	V
Recommended Operation values of Gate-Source voltage	V_{GSop}	-5...-3/+18	V
Continuous drain current ⁽¹⁾	$V_{GS}=18$ V, $T_C=25^\circ\text{C}$	I_D	57
	$V_{GS}=18$ V, $T_C=100^\circ\text{C}$		40
Pulsed drain current ⁽²⁾	$I_{D,pulse}$	142	A
Power dissipation	$T_C=25^\circ\text{C}$	P_D	288
	$T_C=100^\circ\text{C}$		144
Operating junction and storage temperature range	T_J, T_{stg}	-55 to 175	$^\circ\text{C}$
Soldering temperature	T_{solder}	260	
Single Pulse Drain-to-Source Avalanche Energy ⁽³⁾	E_{AS}	200	mJ

TO247-4L



xxxxxxxx-xx
Device code

xxxxxx
Lot number
Work Week code
Year code

2. Thermal resistance ratings

Thermal resistance ratings				
Parameter		Symbol	Max.	Unit
Thermal resistance, junction-to-case	Steady state	$R_{\theta JC}$	0.52	$^{\circ}\text{C/W}$

3. Electrical Characteristics

Electrical characteristics (Tc = 25 °C 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 = 10 mA	2.0	3.0	4.5	V
		V _{DS} = V _{GS} , I _D = 10 mA, T _J = 175 °C		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 = 28 A		40.0	56.0	mΩ
		V _{GS} = 15 V, I _D = 28 A		55.5		
		V _{GS} = 18 V, I _D = 28 A, T _J = 175 °C		64.0		
Forward transconductance	g _{fs}	V _{DS} = 20 V, I _D = 28 A		19.3		S
		V _{DS} = 20 V, I _D = 28 A, T _J = 175 °C		18.0		
Gate resistance	R _g	f=1 MHz		3.0		Ω
Dynamic ⁽⁴⁾						
Input capacitance	C _{iss}	V _{DS} = 800 V, V _{GS} = 0 V, f = 100 kHz		1668		pF
Output capacitance	C _{oss}			105		
Reverse transfer capacitance	C _{rss}			4		
Total gate charge	Q _g	V _{DS} = 800 V, V _{GS} = -3 V/+18 V, I _D = 28 A		62		nC
Gate-source charge	Q _{gs}			20		
Gate-drain charge	Q _{gd}			14		
Turn-on delay time	t _{d(on)}	V _{DS} = 800 V, I _D = 28 A, V _{GS} = -3 V/+18 V, R _{GEN} = 6.8 Ω, L = 84 uH, L _o =40 nH, Timing relative to VDS, Inductive load		22		ns
Rise time	t _r			19.6		
Turn-off delay time	t _{d(off)}			28		
Fall time	t _f			7.6		
Turn-On Switching Energy (SiC Diode FWD)	E _{on}	V _{DS} = 800 V, V _{GS} = -3 V/+18 V, I _D = 28 A, R _{GEN} = 6.8 Ω, L = 84 uH, L _o =40 nH, T _J = 25 °C		332		μJ
Turn Off Switching Energy (SiC Diode FWD)	E _{off}			234		
Reverse Diode Characteristics						
Diode forward voltage	V _{SD}	V _{GS} =-3 V, I _F = 28 A		4.3		V
		V _{GS} =-3 V, I _F = 28 A, T _J = 175 °C		3.8		
Reverse recovery time	t _{rr}	V _{GS} =-3 V, V _{DS} = 800 V, I _F = 28 A, di/dt = 3300 A/μs, T _J = 175 °C		29		ns
Reverse recovery charge	Q _{rr}			731		nC
Peak reverse recovery current	I _{rrm}			37		A

Notes

- (1) Package limited.
- (2) Pulse width limited by maximum junction temperature.
- (3) EAS of 200 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 1\text{ mH}$.
- (4) Guaranteed by design, not subject to production testing.

4. Electrical characteristics diagrams

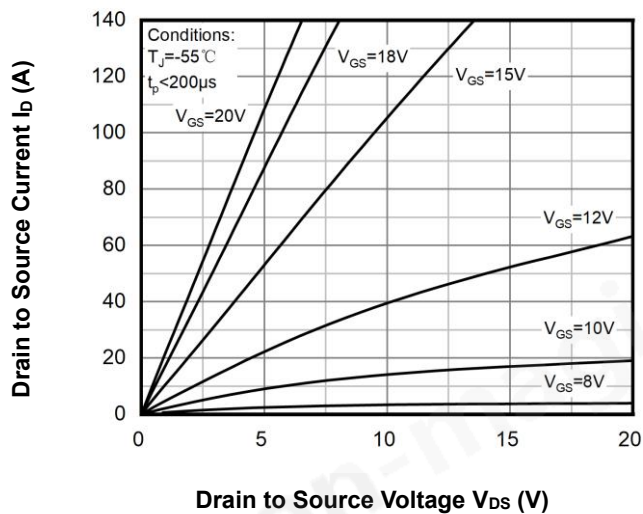
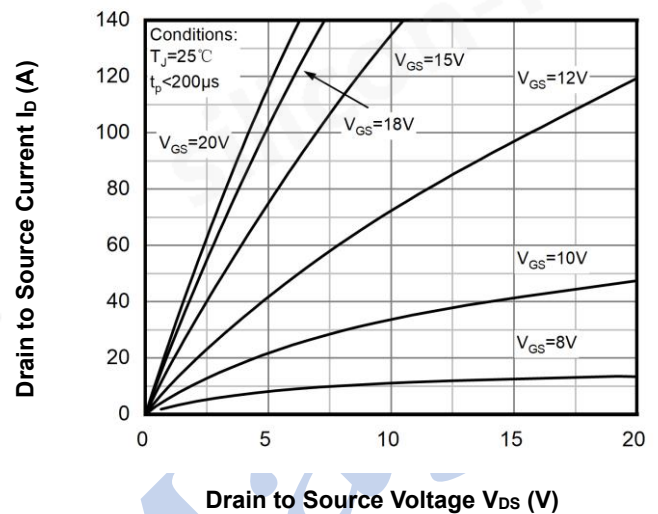
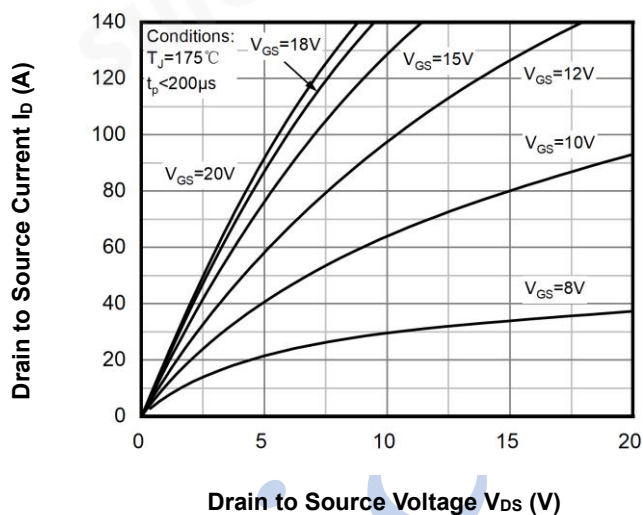
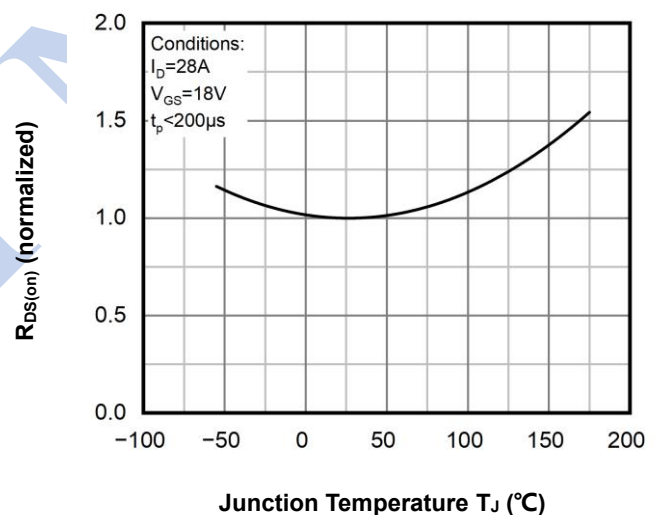
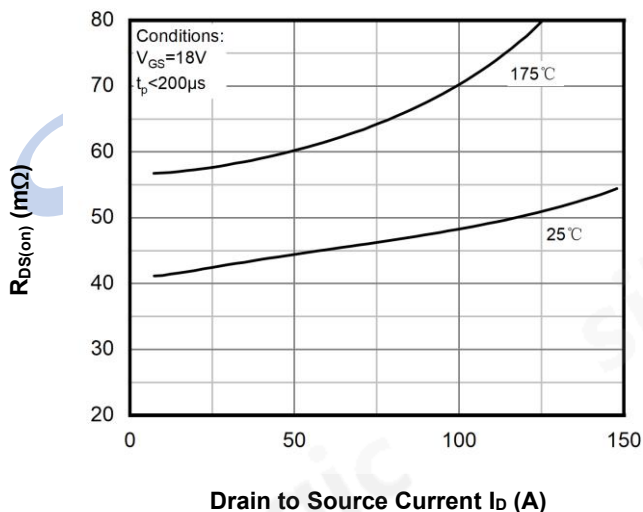
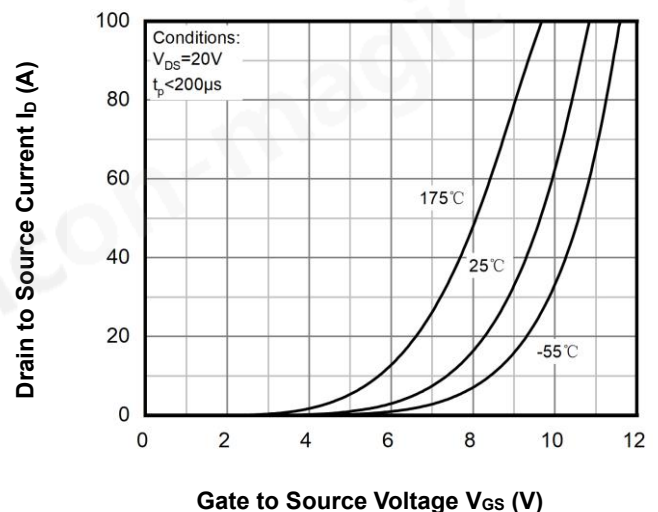
Fig.1 Typ. output characteristics at -55°C

Fig.2 Typ. output characteristics at 25°C

Fig.3 Typ. output characteristics at 175°C

Fig.4 Normalized on-resistance vs junction temperature

Fig.5 Typ. on-resistance vs drain current

Fig.6 Typ. transfer characteristics


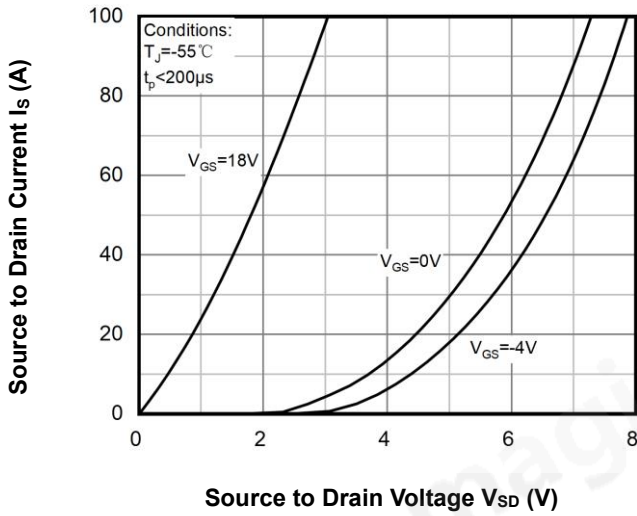
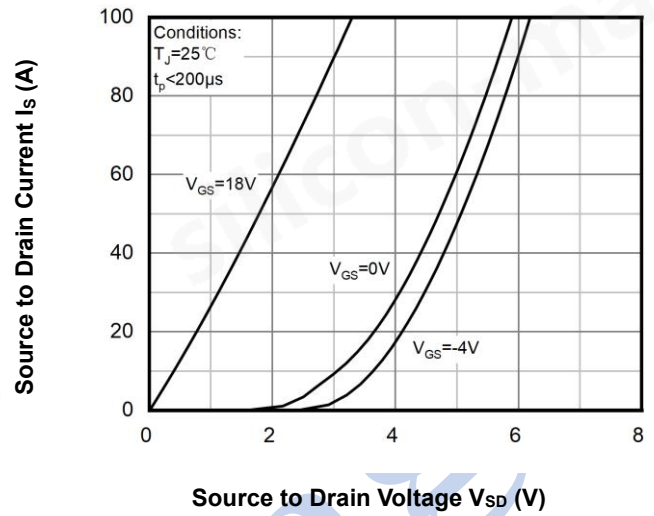
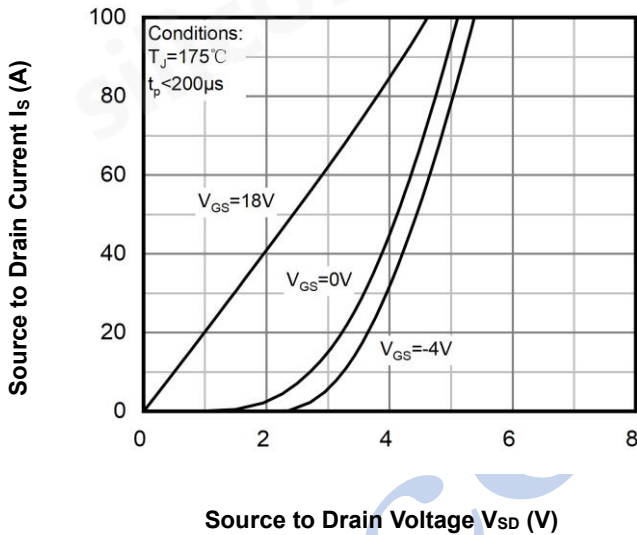
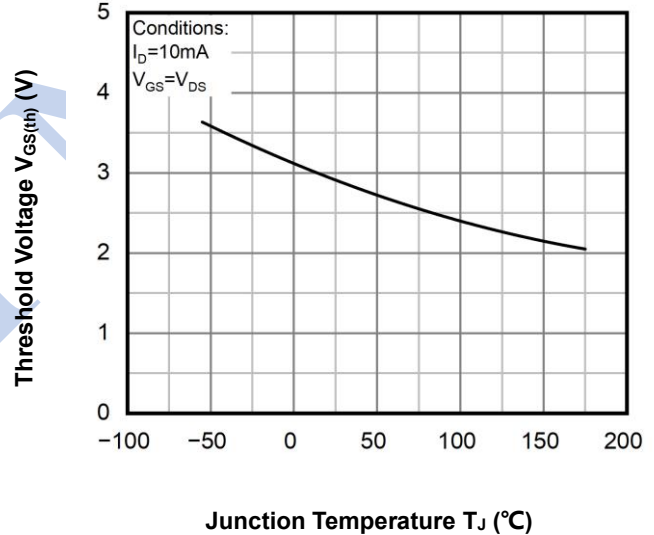
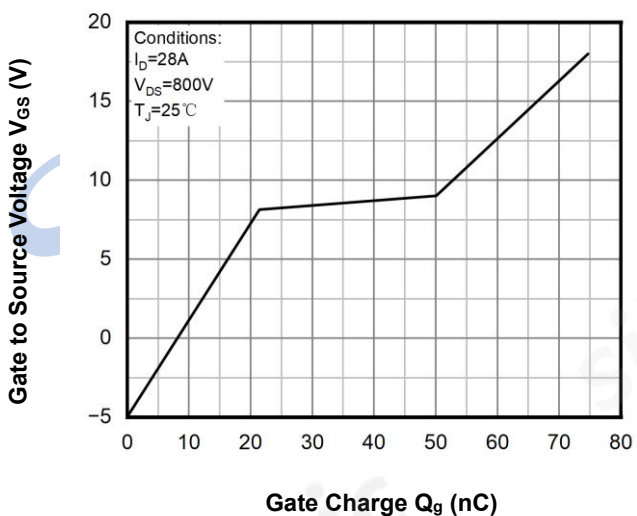
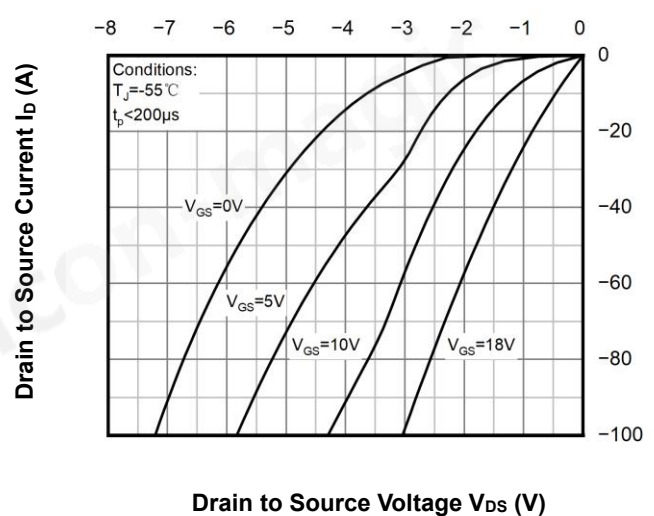
Fig.7 Typ. forward characteristics of body diode at -55°C

Fig.8 Typ. forward characteristics of body diode at 25°C

Fig.9 Typ. forward characteristics of body diode at 175°C

Fig.10 Typ. threshold voltage vs junction temperature

Fig.11 Typ. gate charge

Fig.12 Typ. 3rd quadrant characteristics at -55°C


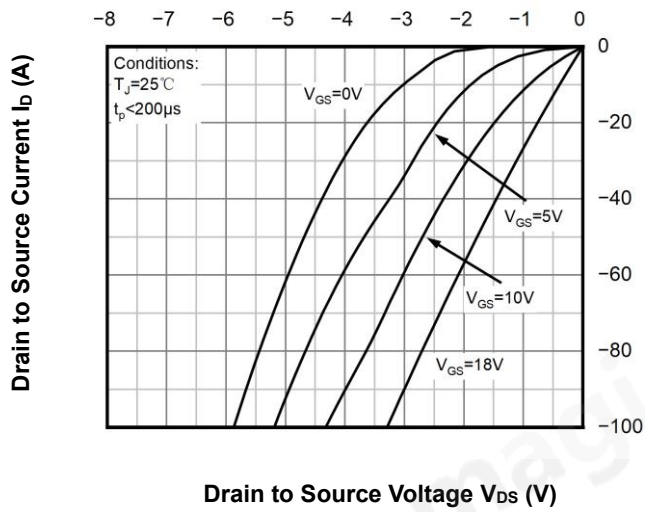
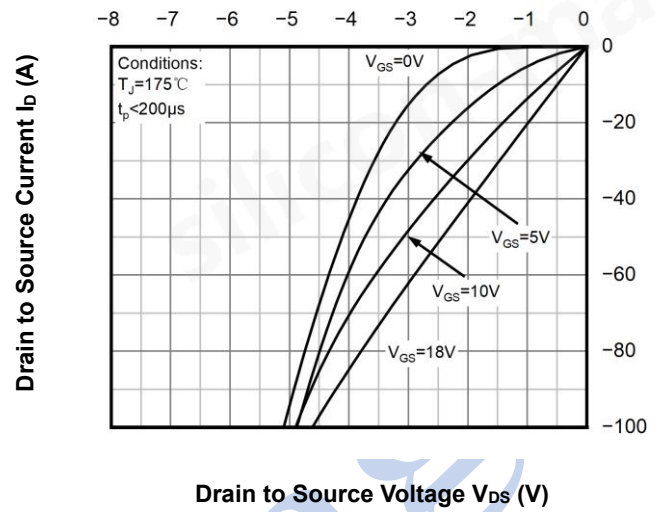
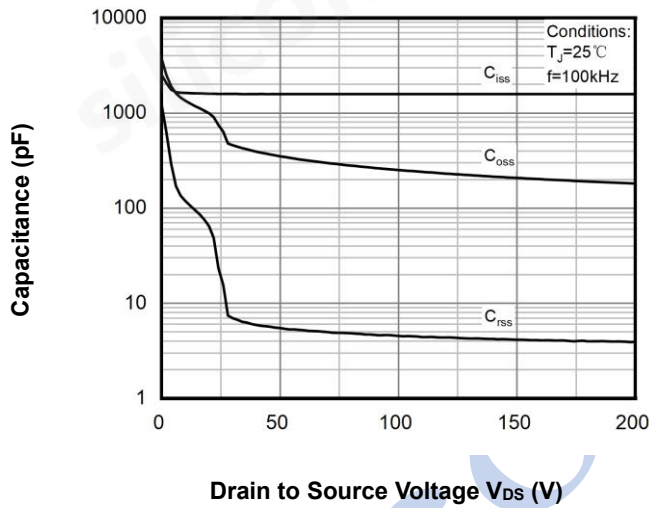
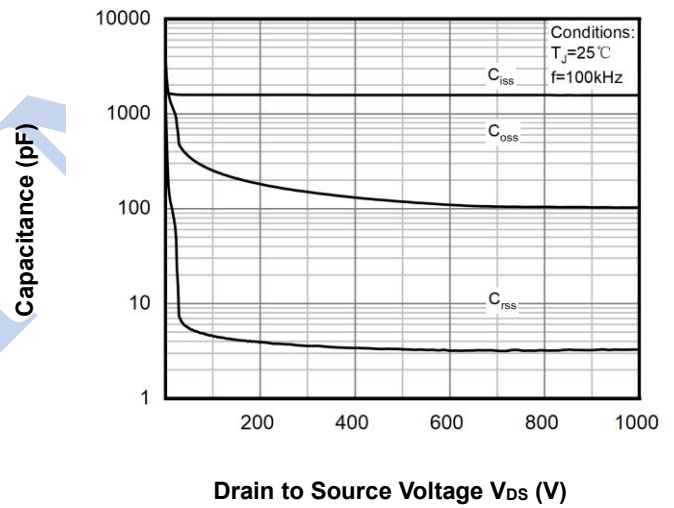
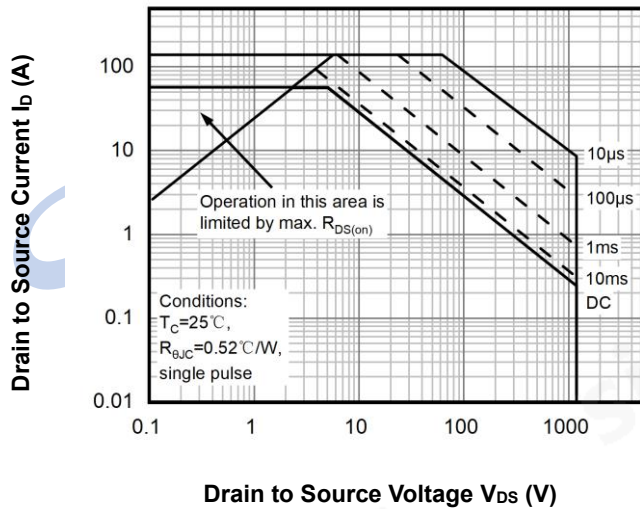
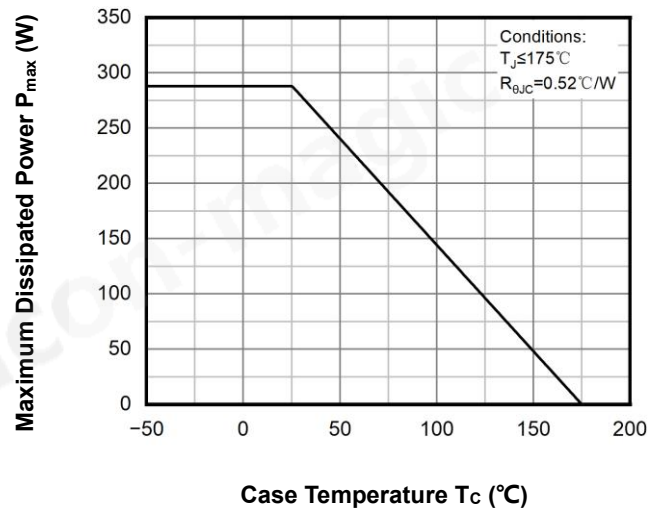
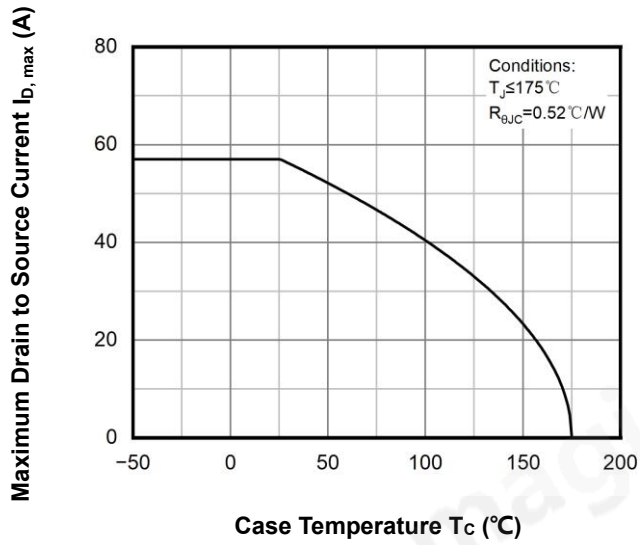
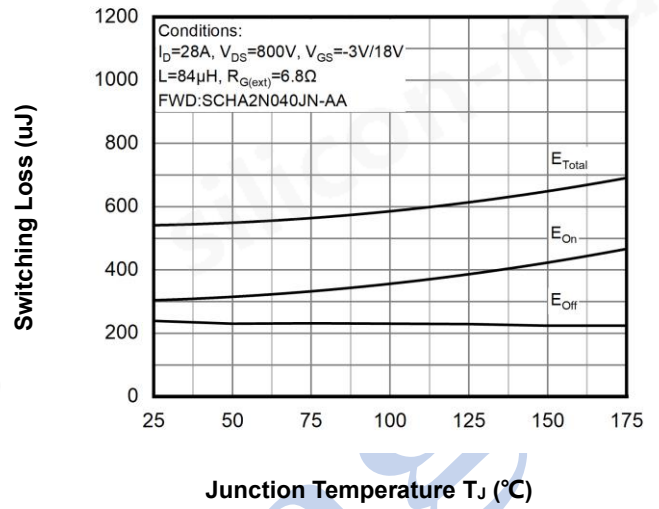
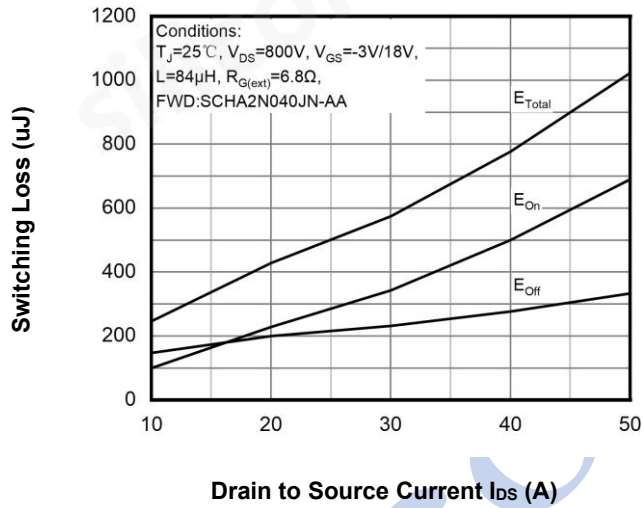
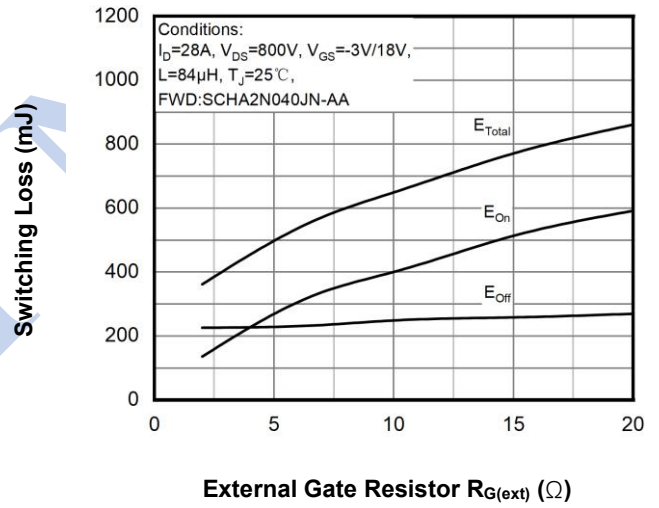
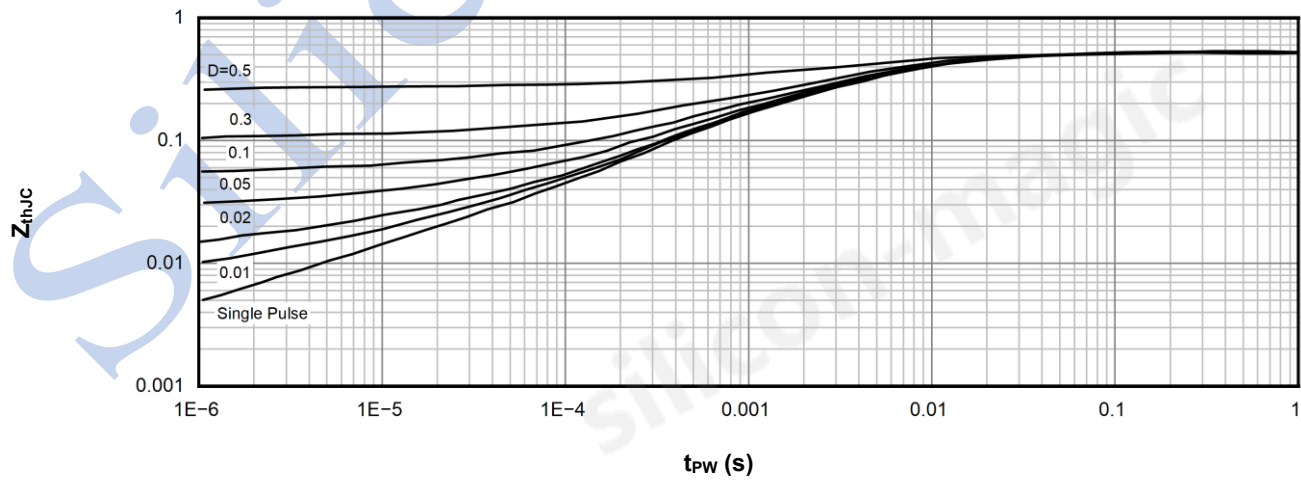
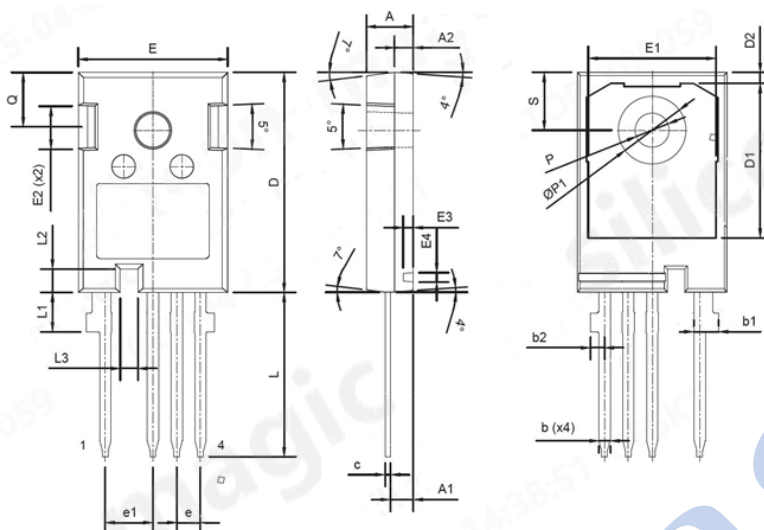
Fig.13 Typ. 3rd quadrant characteristics at 25°C

Fig.14 Typ. 3rd quadrant characteristics at 175°C

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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