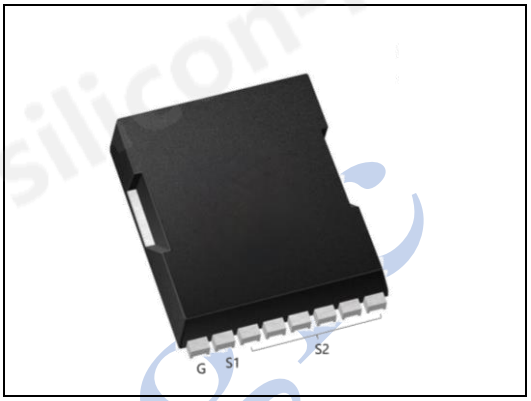
N-Channel Silicon Carbide Power MOSFET

Product summary

V_{DS} (V)	$R_{DS(on),typ}$ (mΩ)	I_D (A)
650	45@ V_{GS} = 18 V	50

TOLL2-8L

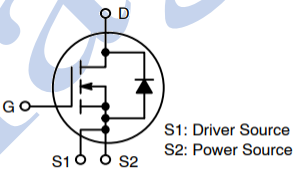


Features

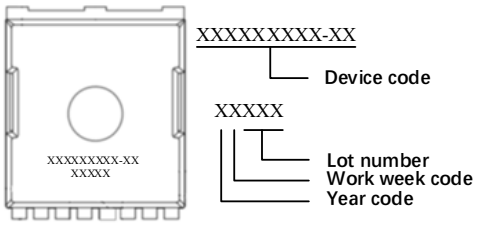
- Silicon carbide material with excellent characteristics
- High blocking voltage with low $R_{DS(on)}$
- Fast switching speed with low capacitance
- Low reverse recovery charge
- High power density, system switching frequency and efficiency.

Applications

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



Pb-free
RoHS COMPLIANT
HALOGEN FREE



Package and ordering information

Ordering code	Package	Device code
SCH65N045QN-AA	TOLL2-8L	H65N045QN-AA

1. Maximum ratings

Absolute maximum ratings (T_C = 25℃ unless otherwise specified)				
Parameter		**Symbol**	**Limit**	**Unit**
Drain-source voltage		V_{DS}	650	V
Gate-source voltage (dynamic)		V_{GSmax}	-10/+22	
Recommended Operation values of Gate-Source voltage		V_{GSop}	-3/+18	V
Continuous drain current(1)	V_{GS}=18 V, T_C=25℃	I_D	50	A
	V_{GS}=18 V, T_C=100℃		36	
Pulsed drain current(2)		$I_{D,pulse}$	135	
Power dissipation	T_C=25℃	P_D	200	W
	T_C=100℃		100	
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		E_{AS}	162	mJ

2. Thermal resistance ratings

Thermal resistance ratings				
Parameter		**Symbol**	**Max.**	**Unit**
Thermal resistance, junction-to-case	Steady state	$R_{\theta JC}$	0.75	°C/W
Thermal resistance, junction-to-ambient	Steady state	$R_{\theta JA}$	40	

3. Electrical Characteristics

Electrical characteristics (T_C = 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	650			V
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 10 mA	1.8	2.7	4.5	V
		V_{DS} = V_{GS}, I_D = 10 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} = 650 V, V_{GS} = 0 V			10	μA
Drain-source on-resistance	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 20 A		45	63	mΩ
		V_{GS} = 15 V, I_D = 20 A		55		
		V_{GS} = 18 V, I_D = 20 A, T_J = 175℃		59		
Forward transconductance	g_{fs}	V_{DS} = 20 V, I_D = 20 A		13.4		S
Gate resistance	R_g	f=1 MHz		4		Ω
Dynamic[3]						
Input capacitance	C_{iss}	V_{DS} = 400 V, V_{GS} = 0 V, f = 100 kHz		1097		pF
Output capacitance	C_{oss}			123		
Reverse transfer capacitance	C_{rss}			6		
Total gate charge	Q_g	V_{DS} = 400 V, V_{GS} = -3 V/+18 V, I_D = 20 A		49.7		nC
Gate-source charge	Q_{gs}			11.5		
Gate-drain charge	Q_{gd}			22.5		
Turn-on delay time	$t_{d(on)}$	V_{DS} = 400 V, I_D = 20 A, V_{GS} = -3 V/+18 V, R_{GEN} = 2.7 Ω, Timing relative to VDS, Inductive load		13		ns
Rise time	t_r			10		
Turn-off delay time	$t_{d(off)}$			26		
Fall time	t_f			5		
Turn-On Switching Energy (SiC Diode FWD)	E_{on}	V_{DS} = 400 V, V_{GS} = -3 V/+18 V, I_D = 20 A, R_{GEN} = 2.7 Ω, T_J = 25℃		32		μJ
Turn Off Switching Energy (SiC Diode FWD)	E_{off}			13.7		
Reverse Diode Characteristics						
Diode forward voltage	V_{SD}	V_{GS} =-3 V, I_F = 20 A		4.4		V
		V_{GS} =-3 V, I_F = 20 A, T_J = 175℃		3.8		
Reverse recovery time	t_{rr}	V_{DS} = 400 V, I_F = 20 A, di/dt = 1000A/μs, Includes Qoss, T_J = 25℃		17		ns
Reverse recovery charge	Q_{rr}			104		nC
Peak reverse recovery current	I_{rrm}			10		A

Notes

(1) Package limited.

(2) Pulse width limited by maximum junction temperature.

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

4. Electrical characteristics diagrams

Fig.1 Typ. output characteristics at -55℃

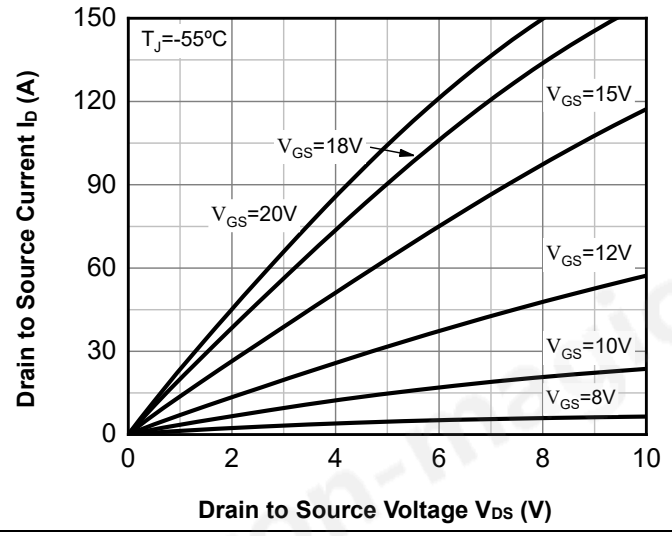


Fig.2 Typ. output characteristics at 25℃

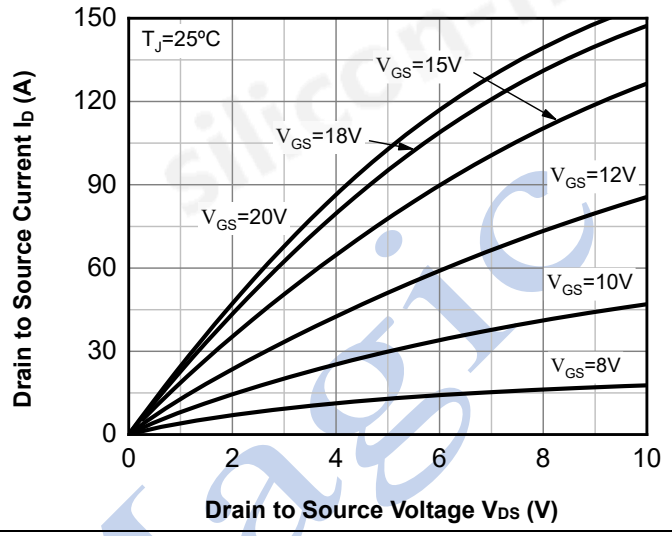


Fig.3 Typ. output characteristics at 175℃

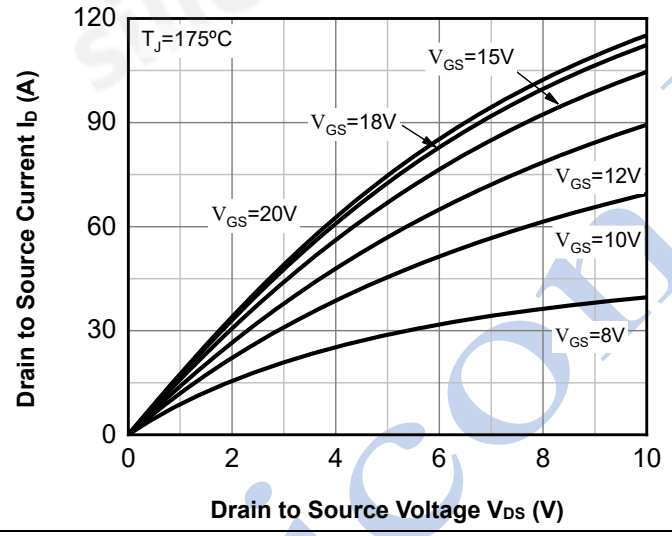


Fig.4 Typ. transfer characteristics

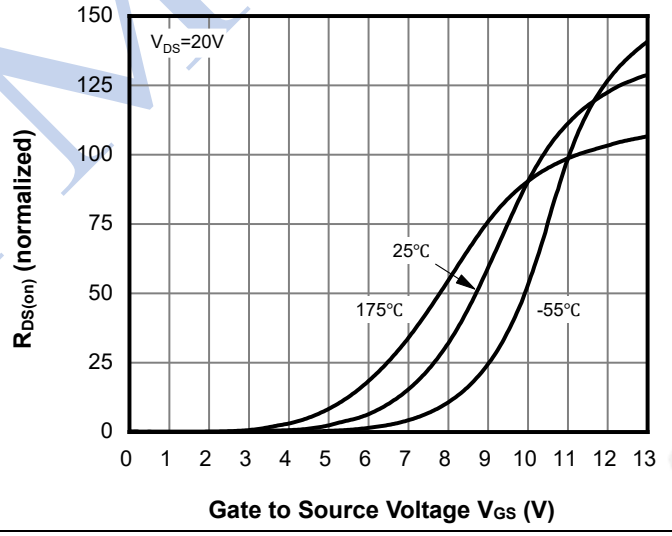


Fig.5 Typ. on-resistance vs drain current

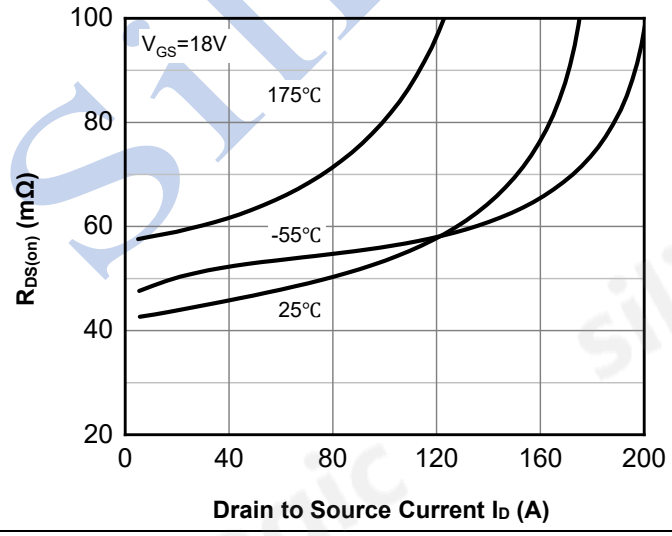


Fig.6 Normalized on-resistance vs junction temperature

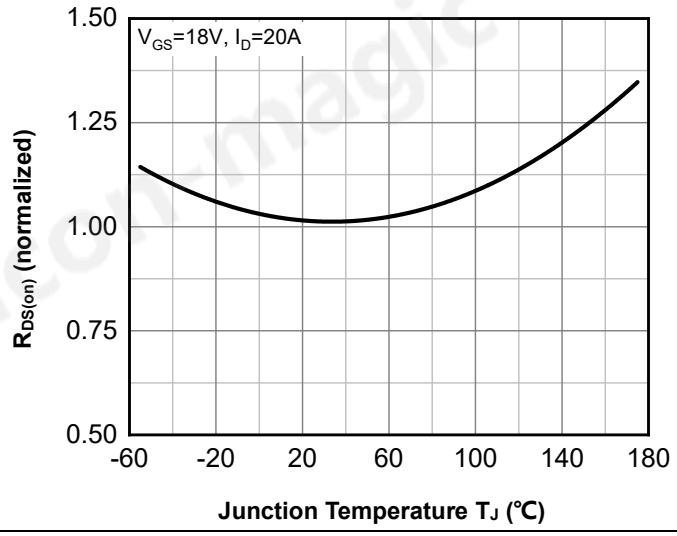


Fig.7 Typ. forward characteristics of body diode at -55℃

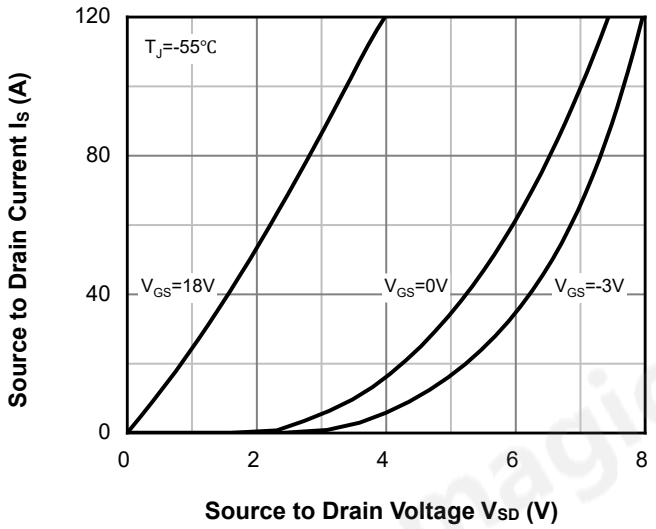


Fig.8 Typ. forward characteristics of body diode at 25℃

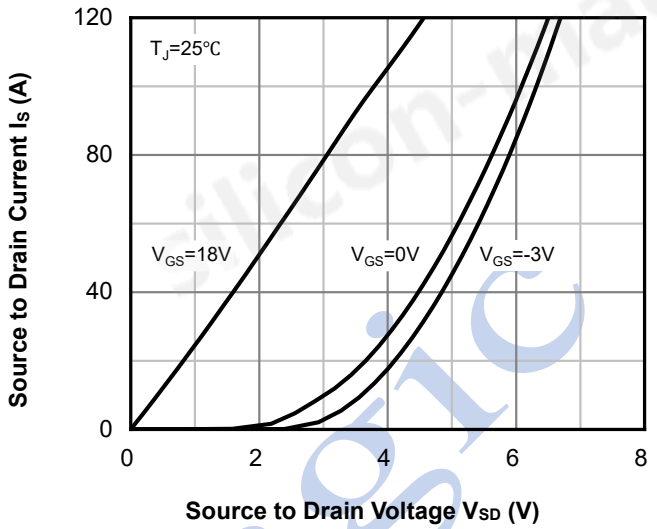


Fig.9 Typ. forward characteristics of body diode at 175℃

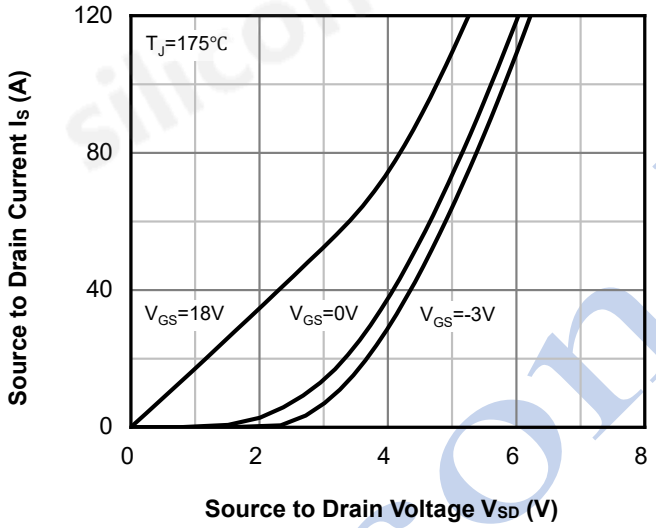


Fig.10 Typ. threshold voltage vs junction temperature

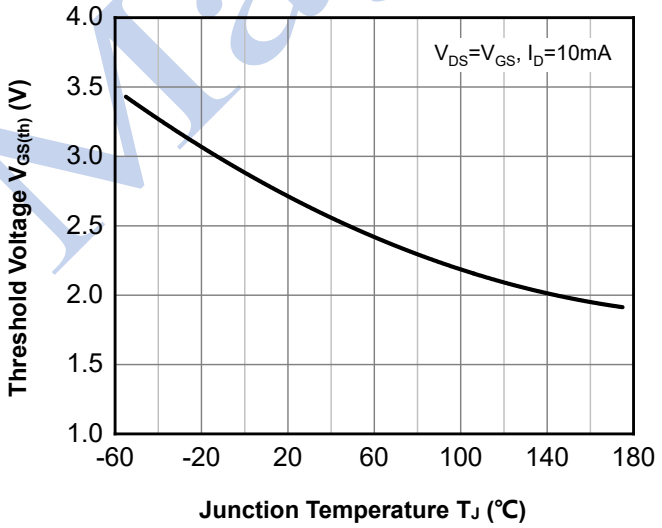


Fig.11 Typ. gate charge

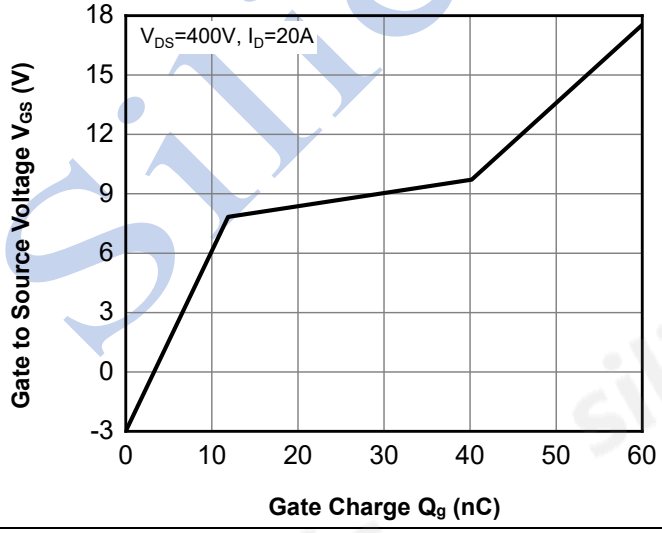


Fig.12 Safe operating area

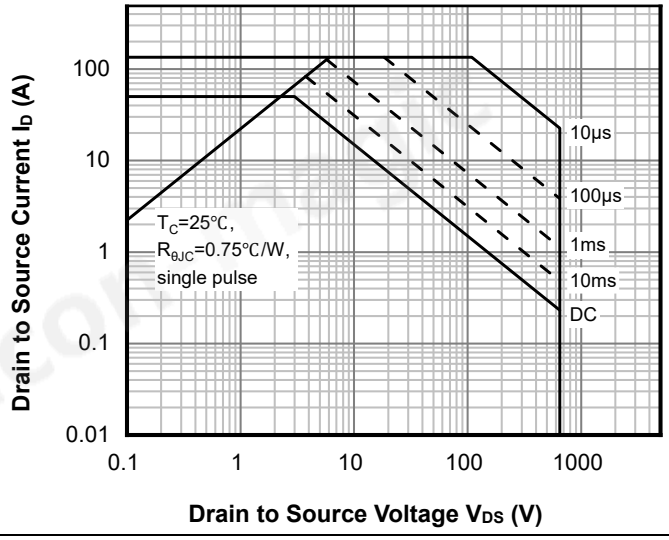


Fig.13 Typ. 3rd quadrant characteristics at 25℃

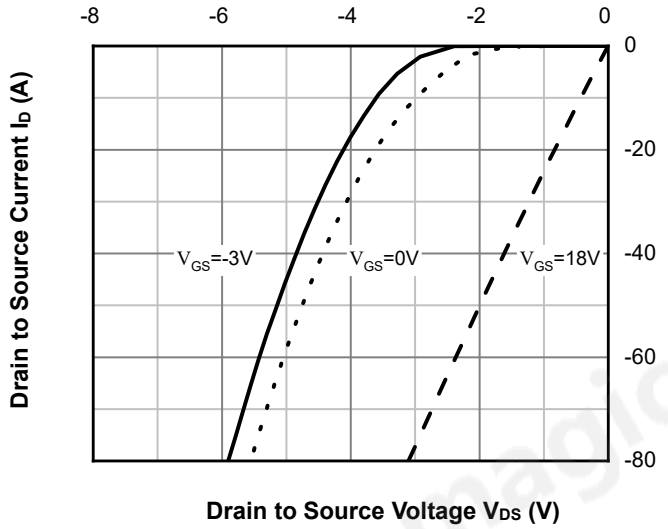


Fig.14 Typ. 3rd quadrant characteristics at 175℃

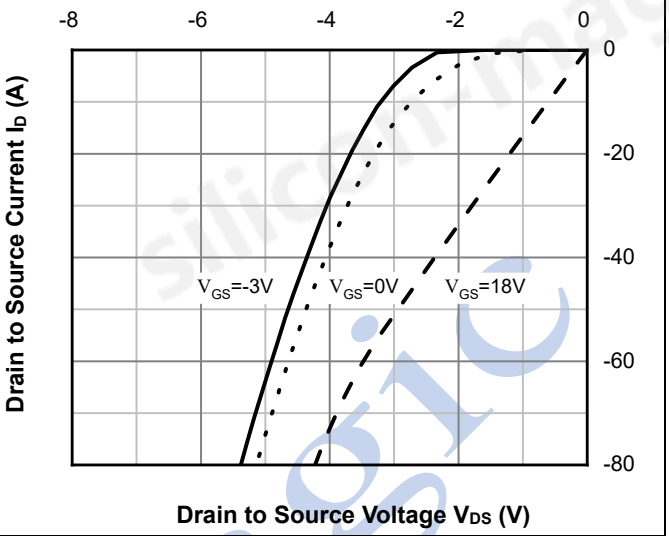


Fig.15 Typ. Capacitance

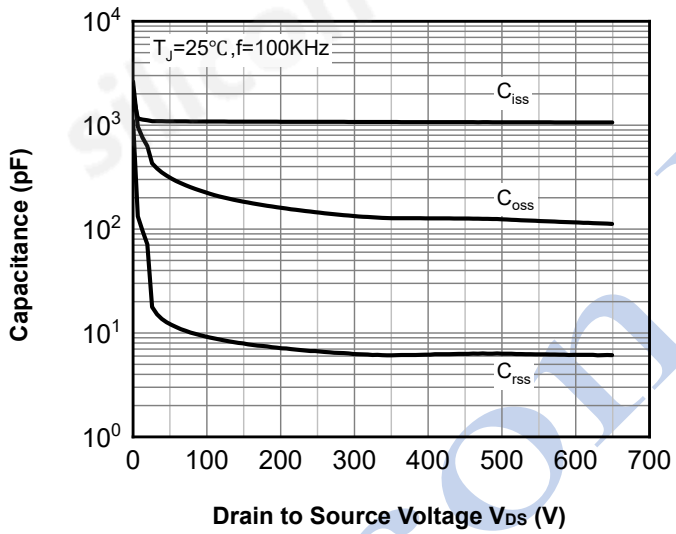


Fig.16 Typ. Qoss output charge

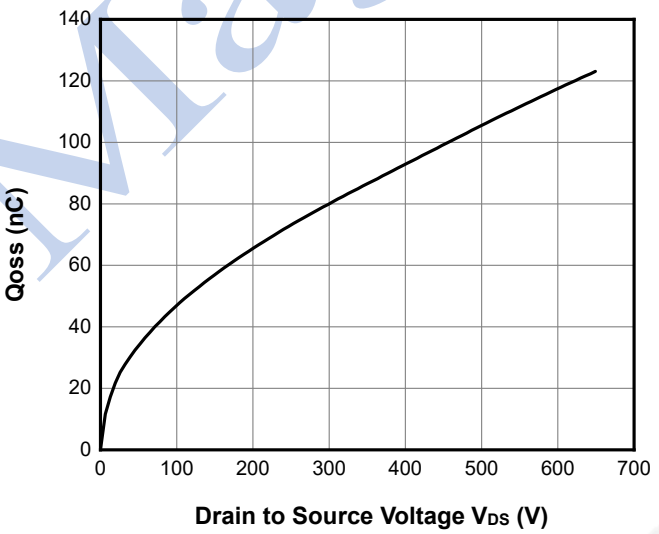


Fig.17 Typ. Coss stored energy

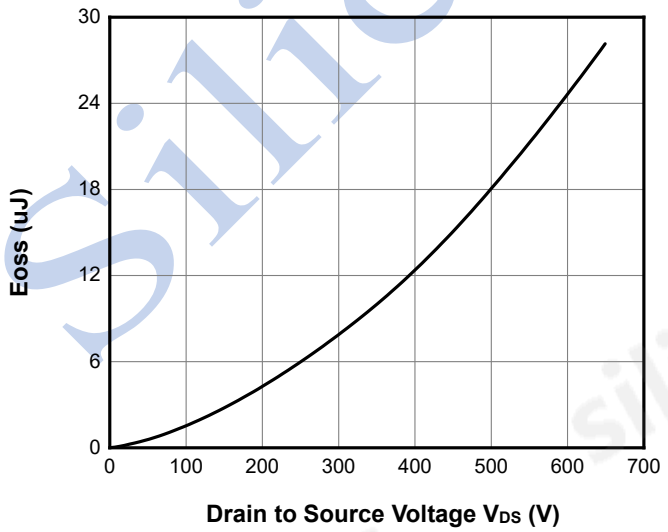


Fig.18 Max. power dissipation vs case temperature

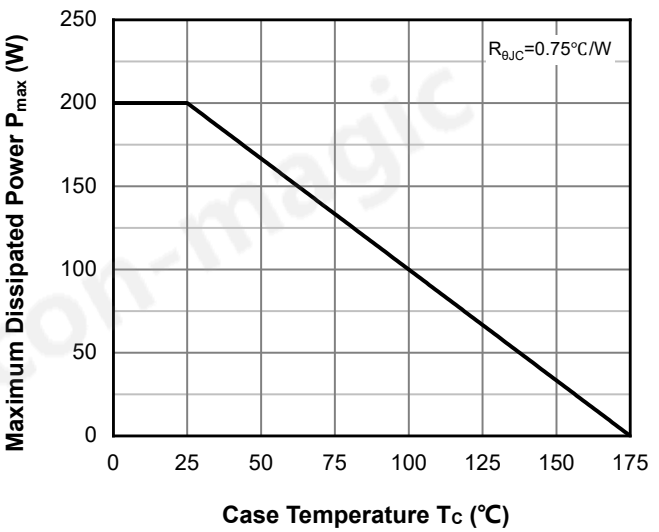


Fig.19 Max. continuous drain current vs. case temperature

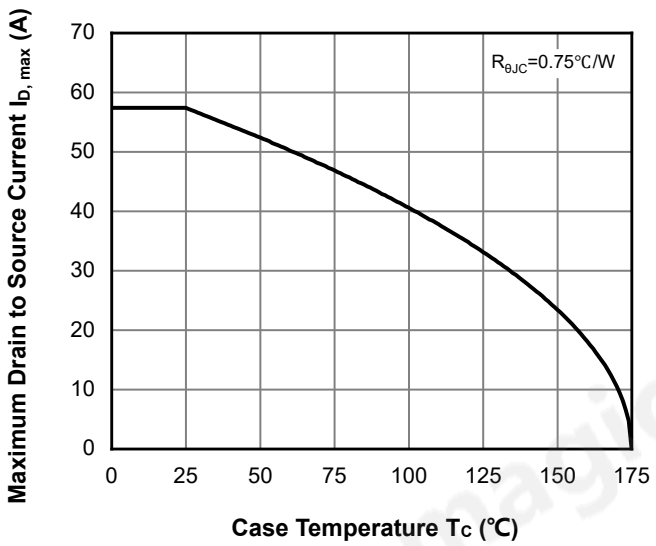


Fig.20 Clamped Inductive Switching Energy vs temperature

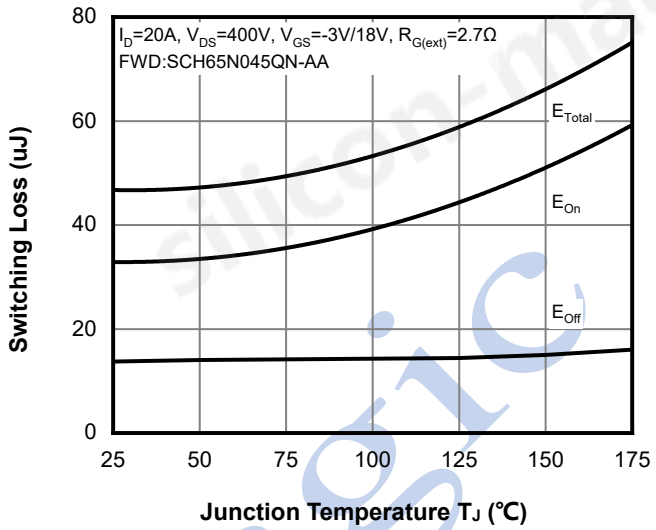


Fig.21 Clamped Inductive Switching Energy vs Drain Current

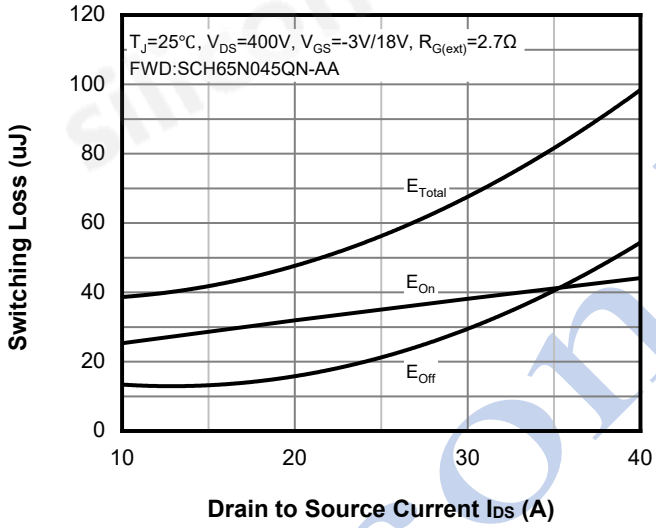


Fig.22 Clamped Inductive Switching Energy vs $R_{G(ext)}$

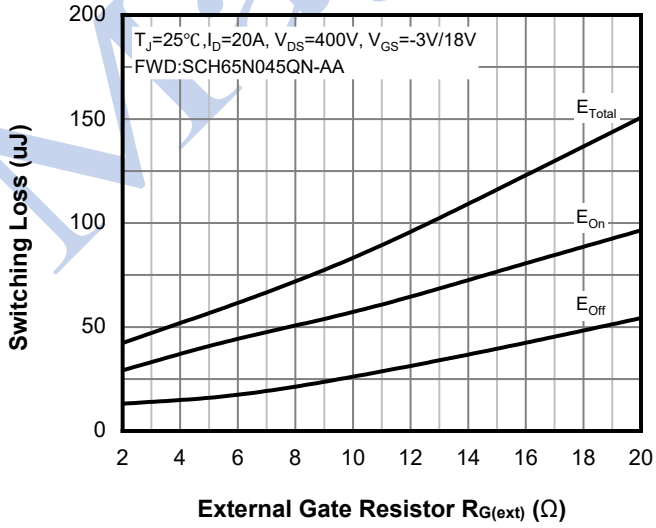
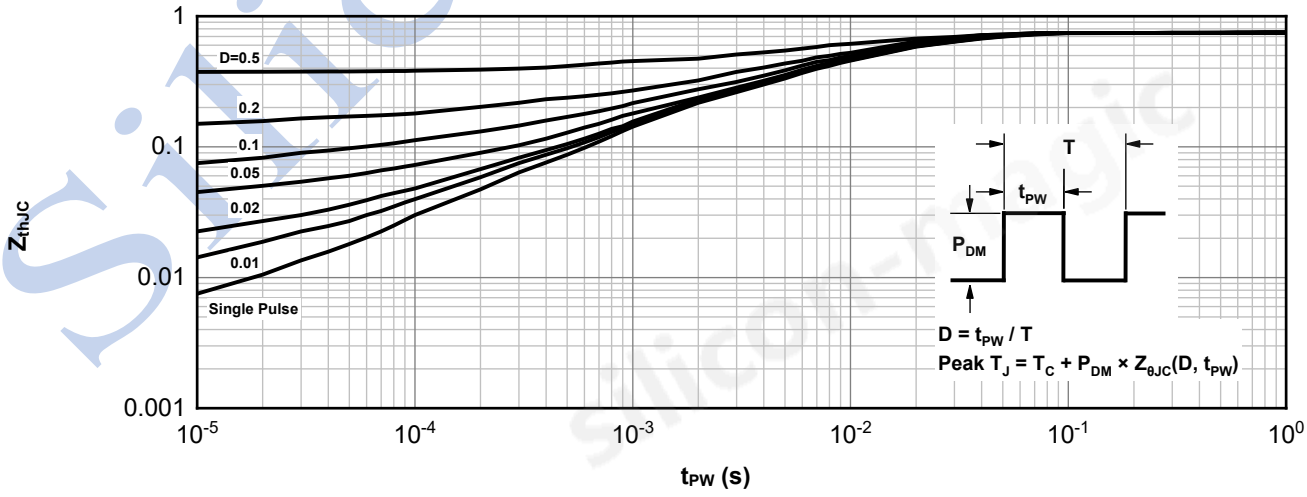
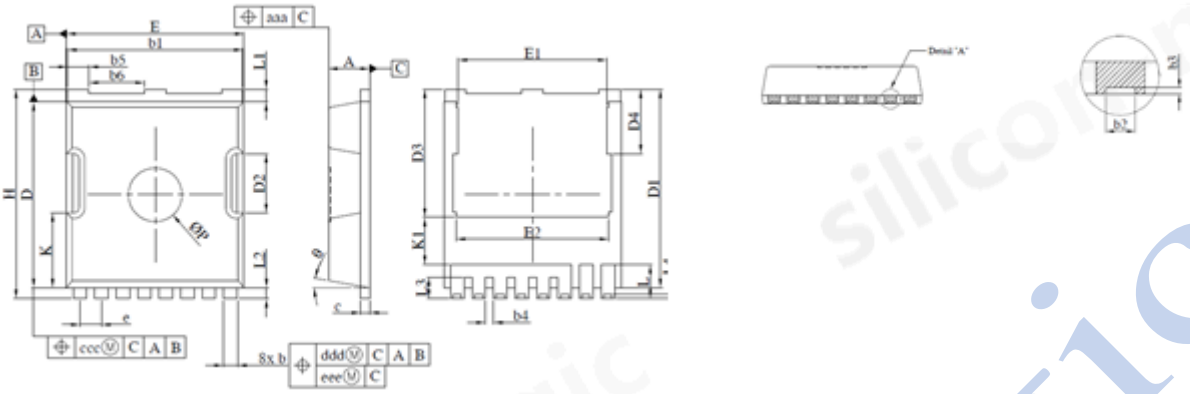


Fig.23 Transient thermal impedance from junction to case



5. Package outline dimensions



Dim	Millimeters		
	Min	Nom	Max
A	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	0.10	0.35
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	7.00	7.15	7.30
D4	3.44	3.59	3.74
e	1.10	1.20	1.30
E	9.80	9.90	10.00
E1	8.20	8.30	8.40
E2	8.35	8.50	8.65
H	11.50	11.68	11.85
K	4.08	4.18	4.28
K1	2.45	-	-
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		

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