

N-channel 60V, 1.2mΩ max.,280A
 SGT MOSFET M1 in PDFN5*6

Datasheet - Preliminary data

1. Descriptions

Key Performance Parameters

Parameters	Value	Unit
BV_{DSS}	60	V
$R_{DS(on),max}$	1.2	mΩ
$Q_{g,typ}$	105	nC
$I_{D,pulse}$	780	A
E_{AS}	462	mJ

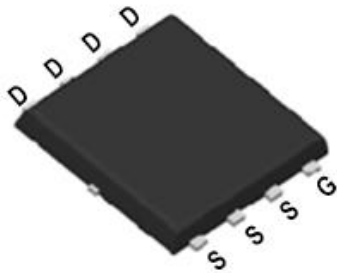
Features

- Extremely low losses due to very low FOM $R_{dson} \cdot Q_g$.
- High-speed switching.
- Qualified for industrial grade applications according to JEDEC.
- 100% UIS Tested.

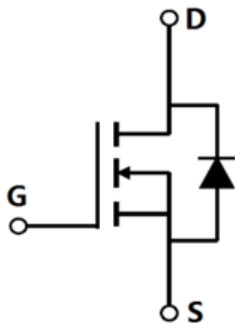
Applications

High-Efficiency DC-DC Converters, High-Frequency Switching and Synchronous Rectification, Motor Drivers.

PDFN5*6



Schematic Diagram



Type/Ordering Code	Package	Marking	Related Links
CSLS012N06M1	PDFN5*6	012N06M1	see Appendix A

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2. Maximum Ratings

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

Table 1. Absolute Maximum Ratings

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
V_{DS}	Drain-source voltage ¹⁾	-	-	60	V	$V_{GS}=0\text{V}$, $I_D=250\mu\text{A}$
I_D	Continuous drain current (Silicon Limited)	-	-	280	A	$T_C=25^\circ\text{C}$
$I_{D,pulse}$	Pulsed drain current ²⁾	-	-	780	A	$T_C=25^\circ\text{C}$
E_{AS}	Avalanche energy, single pulse ³⁾	-	-	462	mJ	$I_D=43\text{A}$; $V_{DD}=30\text{V}$
I_{AS}	Avalanche current	-	-	43	A	-
V_{GS}	Gate source voltage	-20	-	20	V	static; AC ($f>1\text{ Hz}$)
P_{tot}	Power dissipation	-	-	160	W	$T_C=25^\circ\text{C}$
T_j, T_{stg}	Operating and storage temperature	-55	-	150	$^\circ\text{C}$	-
I_S	Continuous diode forward current	-	-	280	A	$T_C=25^\circ\text{C}$
$I_{S,pulse}$	Diode pulse current ²⁾	-	-	780	A	$T_C=25^\circ\text{C}$

1) Limited by T_j max. Maximum duty cycle $D=0.75$.

2) This single-pulse measurement was taken under $T_{j_max}=150^\circ\text{C}$.

3) $V_{DD}=30\text{V}$, $L=0.5\text{mH}$, $R_G=25\Omega$, Starting $T_j=25^\circ\text{C}$.

3. Thermal Characteristics

Table 2. Thermal Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
R_{thJC}	Thermal resistance, junction - case	-	0.6	0.78	°C/W	$T_C = 25^{\circ}\text{C}$
R_{thJA}	Thermal resistance, junction - ambient	-	50	65	°C/W	$T_C = 25^{\circ}\text{C}$
T_{sold}	Soldering temperature, wavesoldering only allowed at leads	-	-	260	°C	Lead Temperature (Soldering, 10 sec)

4. Electrical Characteristics

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

Table 3. Static Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-source breakdown voltage	60	-	-	V	$V_{GS}=0V, I_D=250\mu A$
$V_{(GS)th}$	Threshold gate voltage	1.0	1.6	2.5	V	$V_{DS}=V_{GS}, I_D=250\mu A$
I_{DSS}	Zero gate voltage drain current	-	-	1	μA	$V_{DS}=60V, V_{GS}=0V, T_j=25^\circ C$
I_{GSS}	Gate-source leakage current	-	-	± 100	nA	$V_{GS}=\pm 20V, V_{DS}=0V$
$R_{DS(on)}$	Drain-source on-state resistance	-	0.95	1.2	m Ω	$V_{GS}=10V, I_D=20A, T_j=25^\circ C$
		-	1.3	1.7	m Ω	$V_{GS}=4.5V, I_D=20A, T_j=25^\circ C$
R_G	Gate resistance	-	3.0	-	Ω	$V_{DD}=0V, V_{GS}=0V, F=1MHz$
g_{fs}	Transconductance	-	120	-	S	$V_{DS}=5V, I_D=20A$

Table 4. Dynamic Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
C_{iss}	Input capacitance	-	6300	-	pF	$V_{GS}=0V, V_{DS}=30V, f=1MHz$
C_{oss}	Output capacitance	-	2150	-	pF	$V_{GS}=0V, V_{DS}=30V, f=1MHz$
C_{rss}	Reverse transfer capacitance	-	32	-	pF	$V_{GS}=0V, V_{DS}=30V, f=1MHz$
$t_{d(on)}$	Turn-on delay time	-	17.4	-	ns	$V_{DD}=30V, V_{GS}=10V, I_D=20A, R_G=6\Omega$
t_r	Rise time	-	76	-	ns	$V_{DD}=30V, V_{GS}=10V, I_D=20A, R_G=6\Omega$
$t_{d(off)}$	Turn-off delay time	-	158	-	ns	$V_{DD}=30V, V_{GS}=10V, I_D=20A, R_G=6\Omega$
t_f	Fall time	-	112	-	ns	$V_{DD}=30V, V_{GS}=10V, I_D=20A, R_G=6\Omega$

Table 5. Gate Charge Characteristics

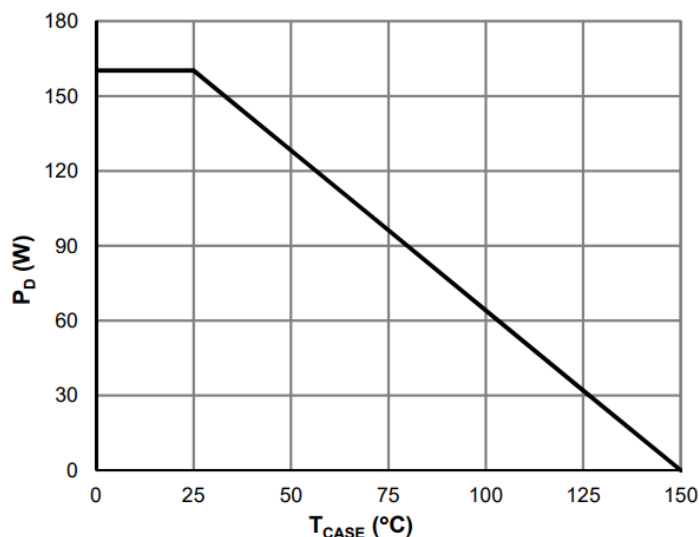
Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
Q_{gs}	Gate to source charge	-	17	-	nC	$V_{DD}=30V, I_D=20A, V_{GS}=0 \text{ to } 10V$
Q_{gd}	Gate to drain charge	-	16	-	nC	$V_{DD}=30V, I_D=20A, V_{GS}=0 \text{ to } 10V$
Q_g	Gate charge total	-	105	-	nC	$V_{DD}=30V, I_D=20A, V_{GS}=0 \text{ to } 10V$
$V_{plateau}$	Gate plateau voltage	-	2.8	-	V	$V_{DD}=30V, I_D=20A, V_{GS}=0 \text{ to } 10V$

Table 6. Reverse Diode Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
V_{SD}	Diode forward voltage	-	0.7	1.2	V	$V_{GS}=0V, I_F=20A, T_j=25^\circ C$
t_{rr}	Reverse recovery time	-	50	-	ns	$V_R=30V, I_F=20A, di_F/dt=100A/\mu s$
Q_{rr}	Reverse recovery charge	-	42	-	nC	$V_R=30V, I_F=20A, di_F/dt=100A/\mu s$

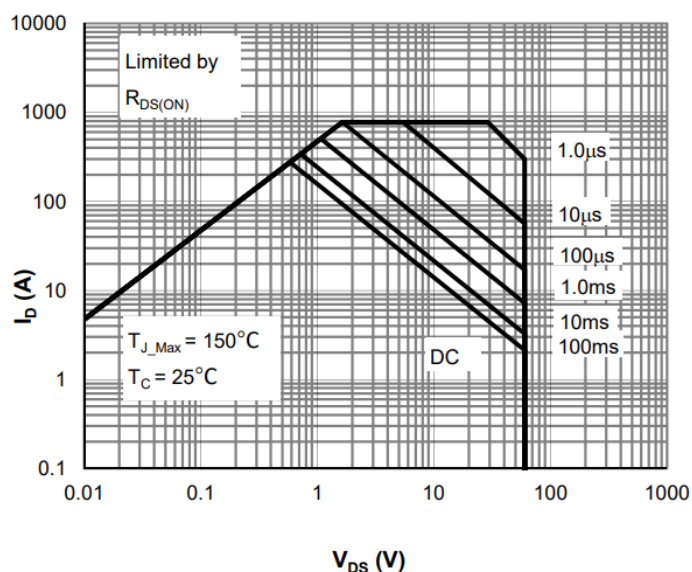
5. Electrical Characteristics Diagrams

Diagram 1: Power dissipation



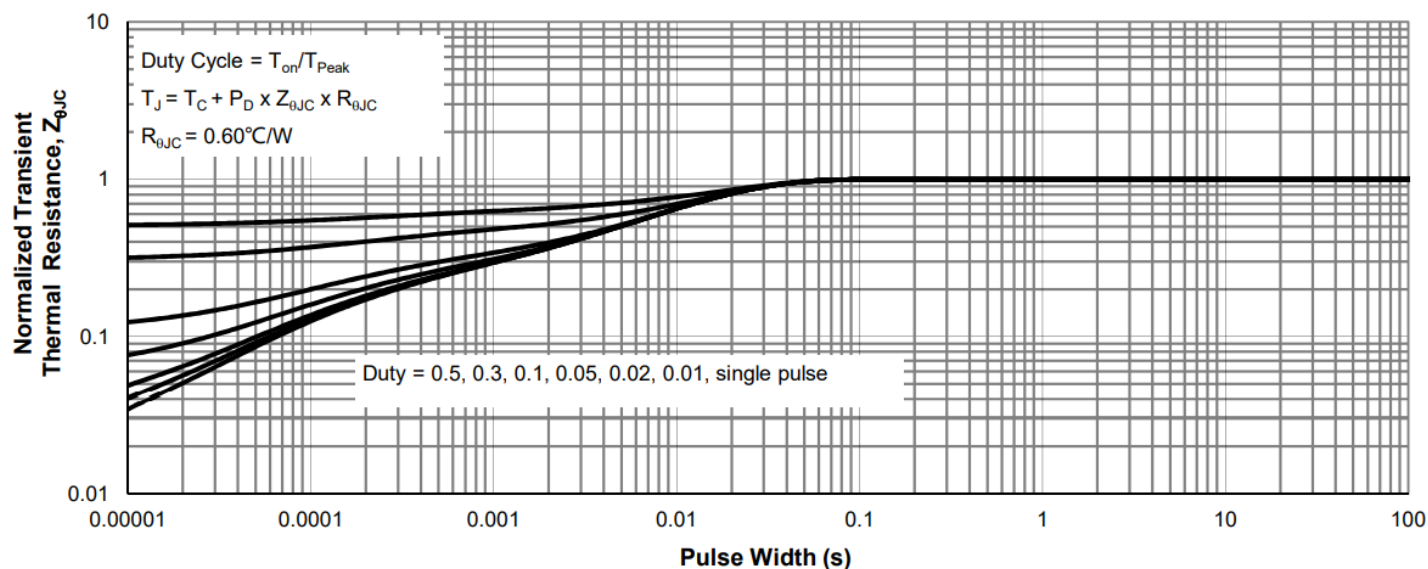
$$P_{tot}=f(T_C)$$

Diagram 2: Max. Safe Operating Area



$$I_D=f(V_{DS})$$

Diagram 3: Normalized Maximum Transient Thermal Impedance



$$Z_{thJC}=f(t_p)$$

Diagram 4: Typ. output characteristics

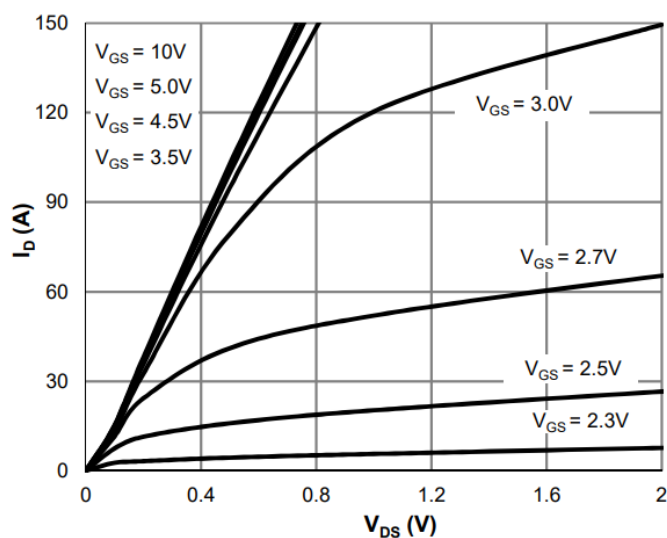

 $I_D = f(V_{DS}); T_J = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 5: Typ. transfer characteristics

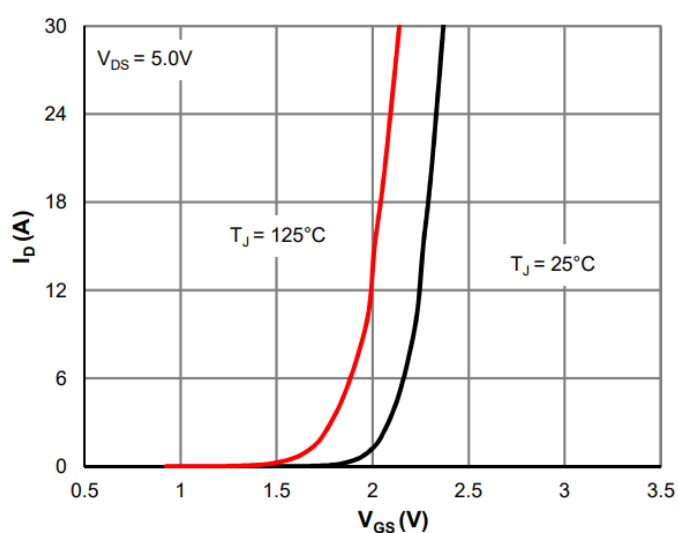

 $I_D = f(V_{GS}); V_{DS} = 5\text{V}; \text{parameter: } T_J$

Diagram 6: Gate threshold voltage vs. Junction temperature

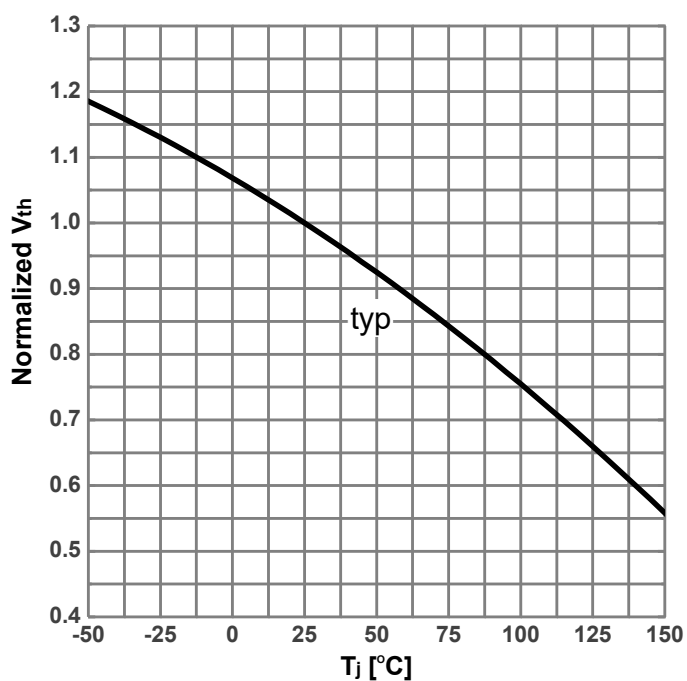

 $V_{th} = f(T_J); I_D = 250\mu\text{A}$

Diagram 7: On-state resistance vs. Drain current

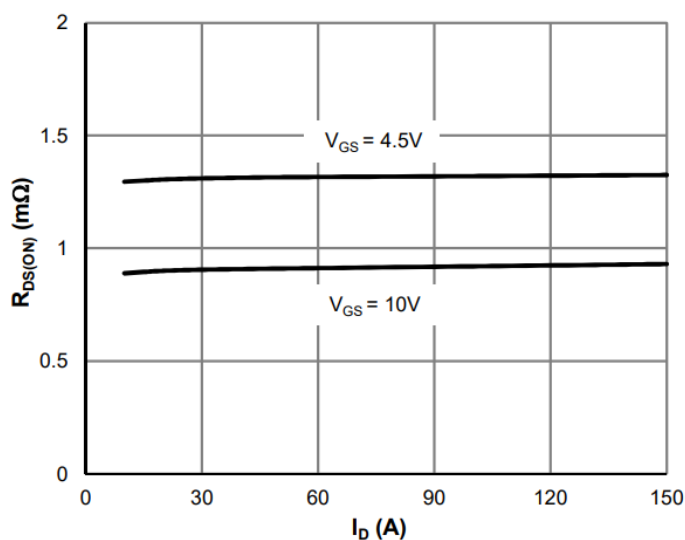
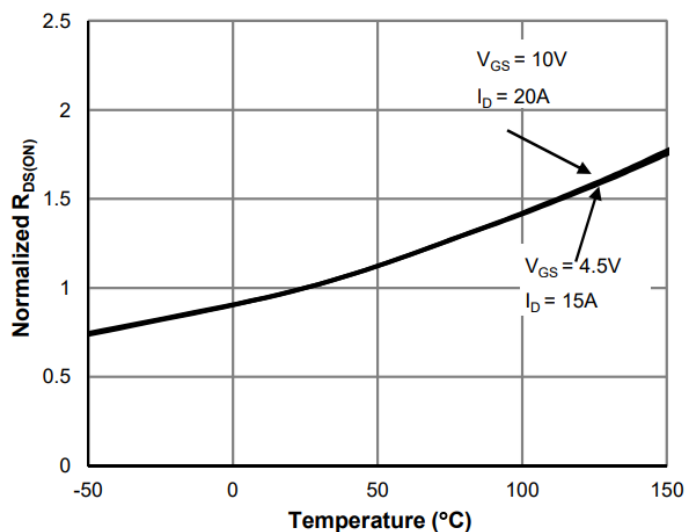
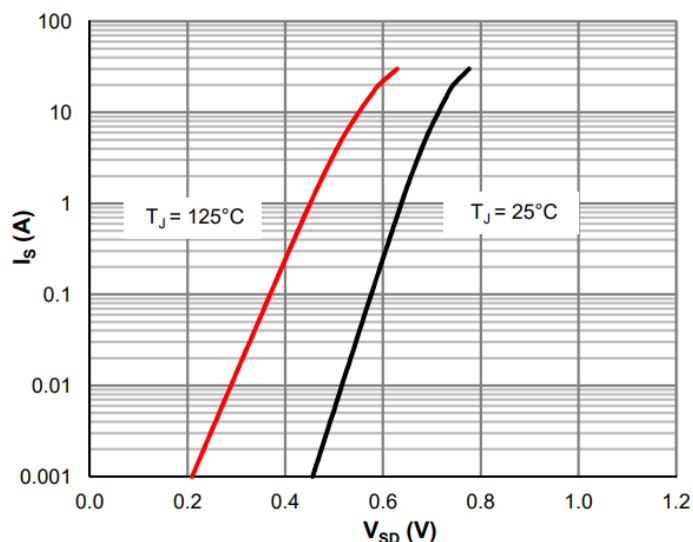
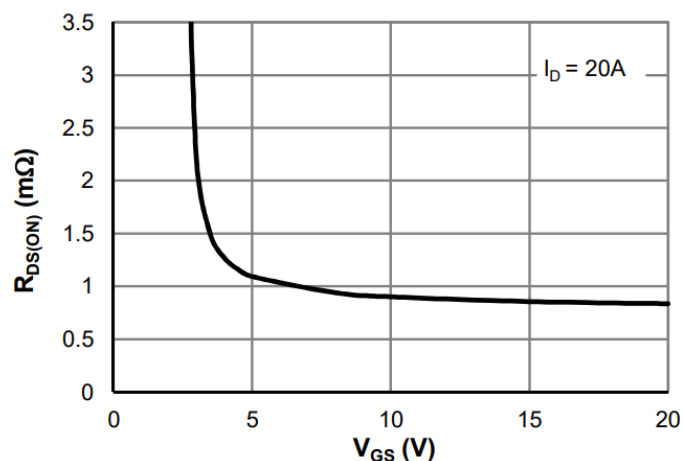

 $R_{DS(on)} = f(I_D); T_J = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 8: On-state resistance vs. Junction temperature

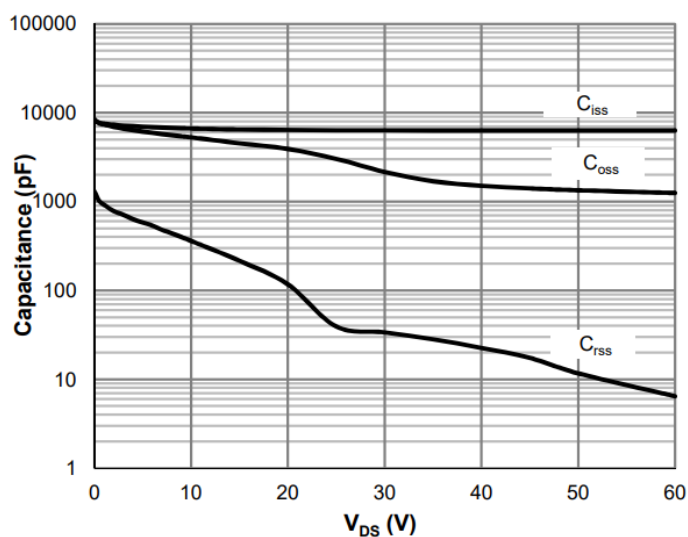
$$R_{DS(on)} = f(T_j)$$

Diagram 9: Forward characteristics of reverse diode

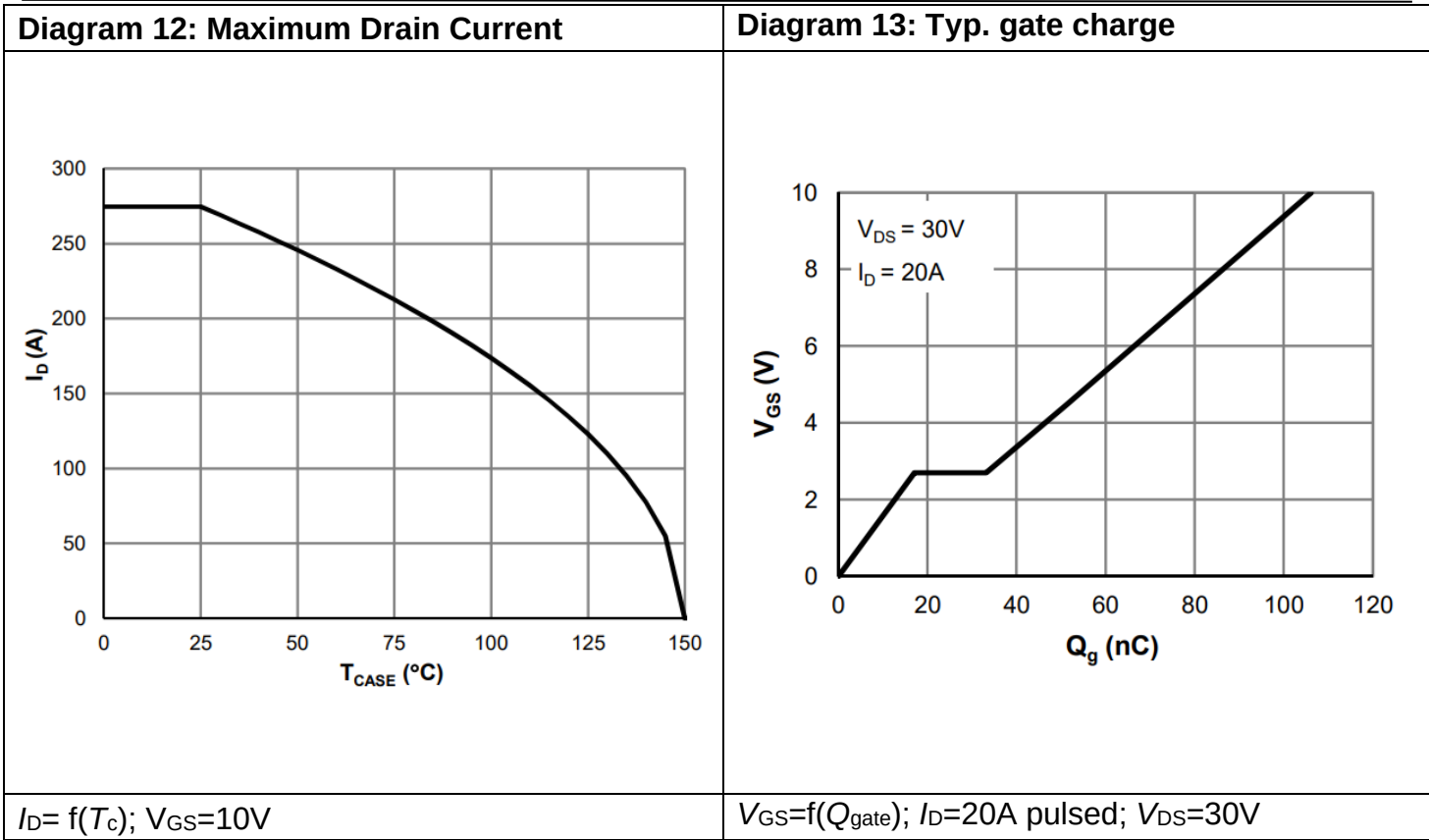
$$I_S = f(V_{SD}); \text{ parameter: } T_j$$

Diagram 10: On-state resistance vs. V_{GS} characteristics

$$R_{DS(on)} = f(V_{GS}); T_J = 25^{\circ}C; I_D = 20A$$

Diagram 11: Typ. capacitances

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



6. Test Circuits

Table 7. Diode Characteristics

Test circuit for diode characteristics $R_{g1} = R_{g2}$	Diode recovery waveform $V_{DS(peak)}$ V_{DS} I_F I_m t_F t_T t_S dI_F/dt dI_T/dt $10\% I_m$ Q_F Q_S $Q_{Tr} = Q_F + Q_S$ $t_{Tr} = t_F + t_S$
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Table 8. Switching Times

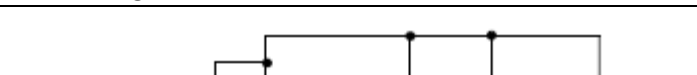
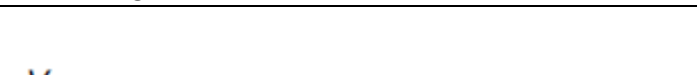
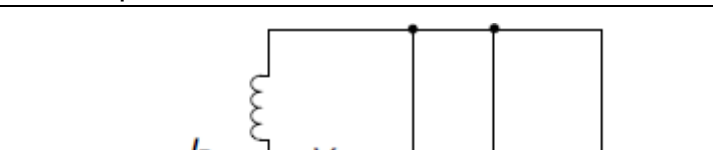
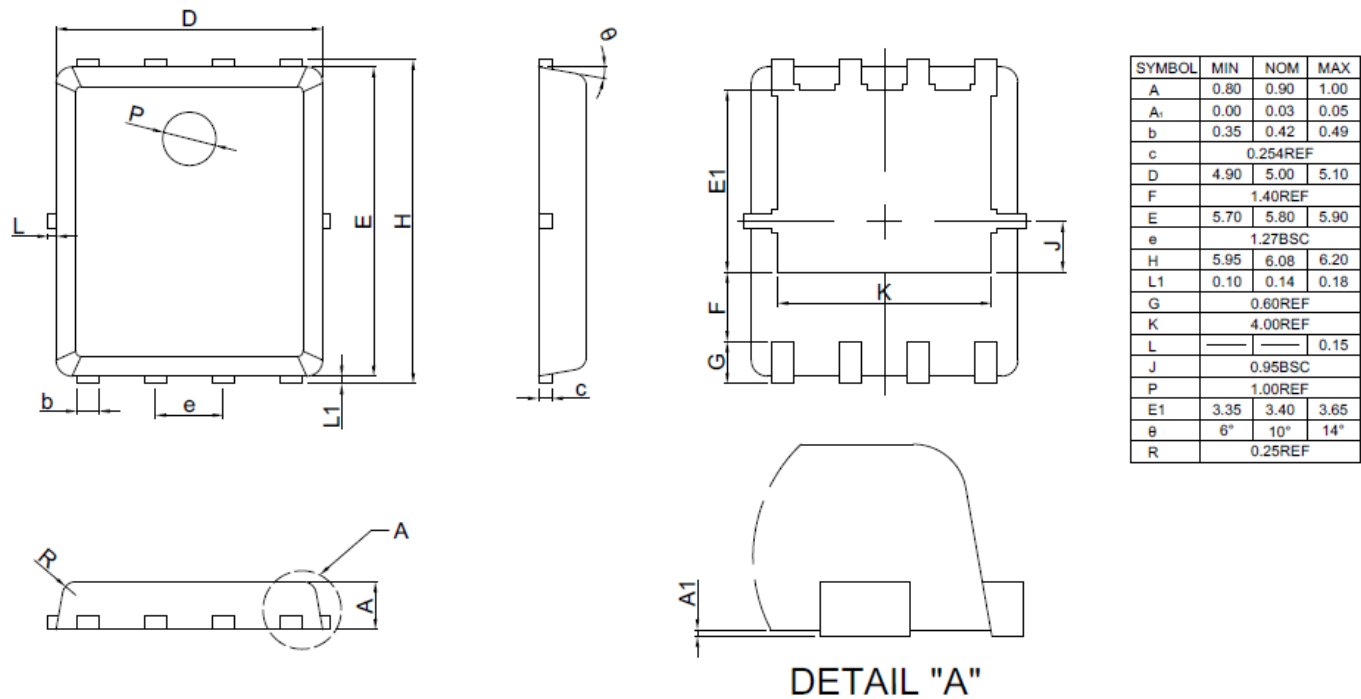
Switching times test circuit for inductive load 	Switching times waveform 
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Table 9. Unclamped Inductive Load

Unclamped inductive load test circuit 	Unclamped inductive waveform 
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7. Package Outlines

Figure 1 Outline PDFN5*6 Dimensions in mm



8. Appendix

CoolSemi Webpage: www.coolsemi.com.