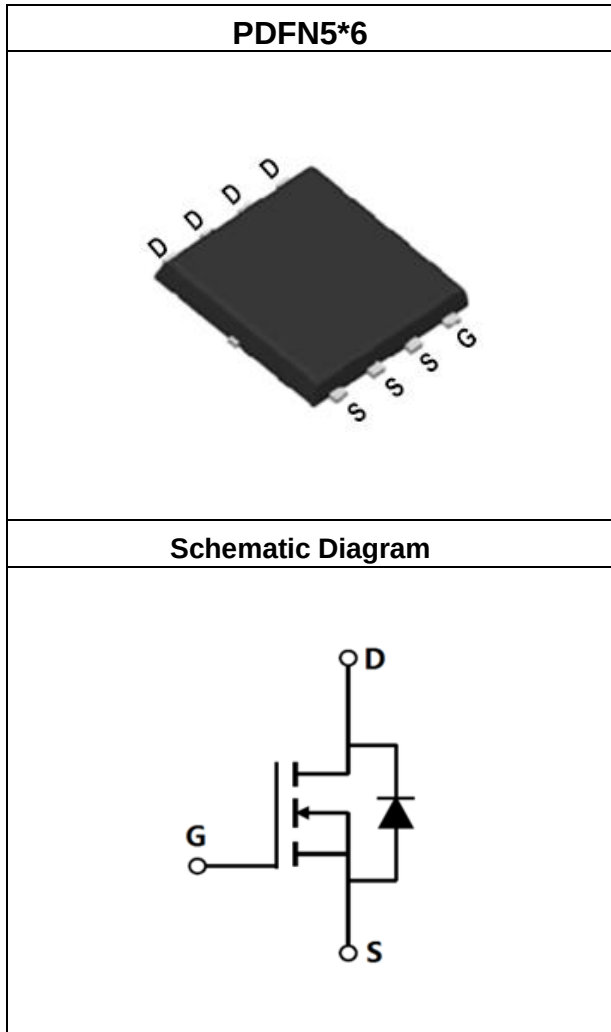


N-channel 40V, 5.0mΩ max.,320A
 SGT MOSFET M1 in PDFN5*6

Datasheet - Preliminary data

1. Descriptions



Key Performance Parameters

Parameters	Value	Unit
BV_{DSS}	40	V
$R_{DS(on),max}$	5.0	mΩ
$Q_{g,type}$	18	nC
$I_{D,pulse}$	255	A
E_{AS}	36	mJ

Features

- Extremely low losses due to very low FOM $R_{ds(on)} \cdot Q_g$.
- 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.

Type/Ordering Code	Package	Marking	Related Links
CSLS050N04M1	PDFN5*6	050N04M1	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⁾	-	-	40	V	$V_{GS}=0V$, $I_D=250\mu A$
I_D	Continuous drain current (Silicon Limited)	-	-	70	A	$T_C=25^\circ\text{C}$
$I_{D,pulse}$	Pulsed drain current	-	-	255	A	$T_C=25^\circ\text{C}$
E_{AS}	Avalanche energy, single pulse ²⁾	-	-	36	mJ	$I_D=27A$; $V_{DD}=20V$
I_{AS}	Avalanche current	-	-	27	A	-
V_{GS}	Gate source voltage	-20	-	20	V	static; AC ($f>1\text{ Hz}$)
P_{tot}	Power dissipation	-	-	42	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	-	-	70	A	$T_C=25^\circ\text{C}$
$I_{S,pulse}$	Diode pulse current	-	-	255	A	$T_C=25^\circ\text{C}$

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

2) $V_{DD}=20V$, $L=0.1mH$, $R_G=25\Omega$, 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	-	2.3	3.0	°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	40	-	-	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	$V_{DS}=40V, V_{GS}=0V, T_j=25^\circ C$
I_{GSS}	Gate-source leakage current	-	-	± 100	nA	$V_{GS}=\pm 20V, V_{DS}=0V$
$R_{DS(on)}$	Drain-source on-state resistance	-	4.1	5.0	m Ω	$V_{GS}=10V, I_D=20A, T_j=25^\circ C$
		-	5.5	7.5	m Ω	$V_{GS}=4.5V, I_D=20A, T_j=25^\circ C$
R_G	Gate resistance	-	1.8	-	Ω	$V_{DD}=0V, V_{GS}=0V, F=1MHz$
g_{fs}	Transconductance	-	80	-	S	$V_{DS}=5V, I_D=20A$

Table 4. Dynamic Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
C_{iss}	Input capacitance	-	1200	-	pF	$V_{GS}=0V, V_{DS}=20V, f=1MHz$
C_{oss}	Output capacitance	-	530	-	pF	$V_{GS}=0V, V_{DS}=20V, f=1MHz$
C_{rss}	Reverse transfer capacitance	-	50	-	pF	$V_{GS}=0V, V_{DS}=20V, f=1MHz$
$t_{d(on)}$	Turn-on delay time	-	4.8	-	ns	$V_{DD}=20V, V_{GS}=10V, I_D=20A, R_G=6\Omega$
t_r	Rise time	-	8.5	-	ns	$V_{DD}=20V, V_{GS}=10V, I_D=20A, R_G=6\Omega$
$t_{d(off)}$	Turn-off delay time	-	23	-	ns	$V_{DD}=20V, V_{GS}=10V, I_D=20A, R_G=6\Omega$
t_f	Fall time	-	15	-	ns	$V_{DD}=20V, V_{GS}=10V, I_D=20A, R_G=6\Omega$

Table 5. Gate Charge Characteristics

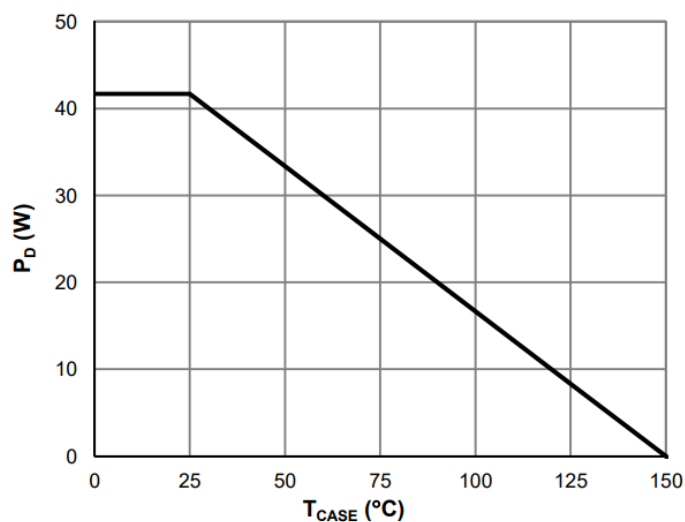
Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
Q_{gs}	Gate to source charge	-	3.2	-	nC	$V_{DD}=20V, I_D=20A, V_{GS}=0 \text{ to } 10V$
Q_{gd}	Gate to drain charge	-	4.0	-	nC	$V_{DD}=20V, I_D=20A, V_{GS}=0 \text{ to } 10V$
Q_g	Gate charge total	-	18	-	nC	$V_{DD}=20V, I_D=20A, V_{GS}=0 \text{ to } 10V$
$V_{plateau}$	Gate plateau voltage	-	2.8	-	V	$V_{DD}=20V, I_D=20A, V_{GS}=0 \text{ to } 10V$

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	$V_R=20V, I_F=20A, di_F/dt=100A/\mu s$
Q_{rr}	Reverse recovery charge	-	42	-	nC	$V_R=20V, I_F=20A, di_F/dt=100A/\mu s$

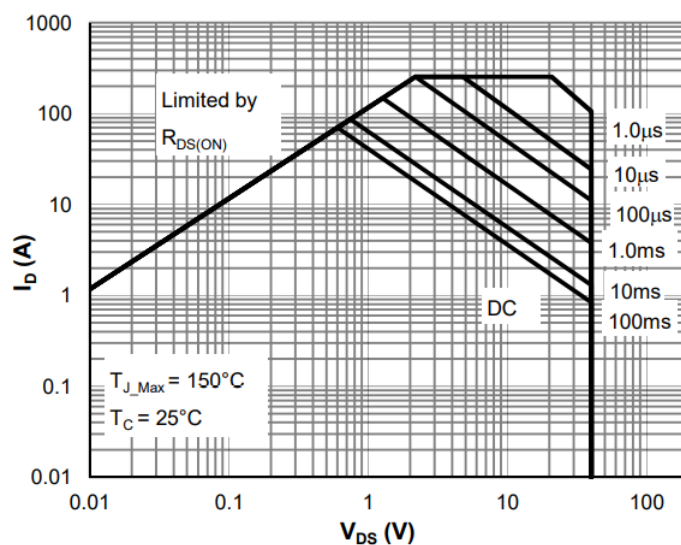
5. Electrical Characteristics Diagrams

Diagram 1: Power dissipation



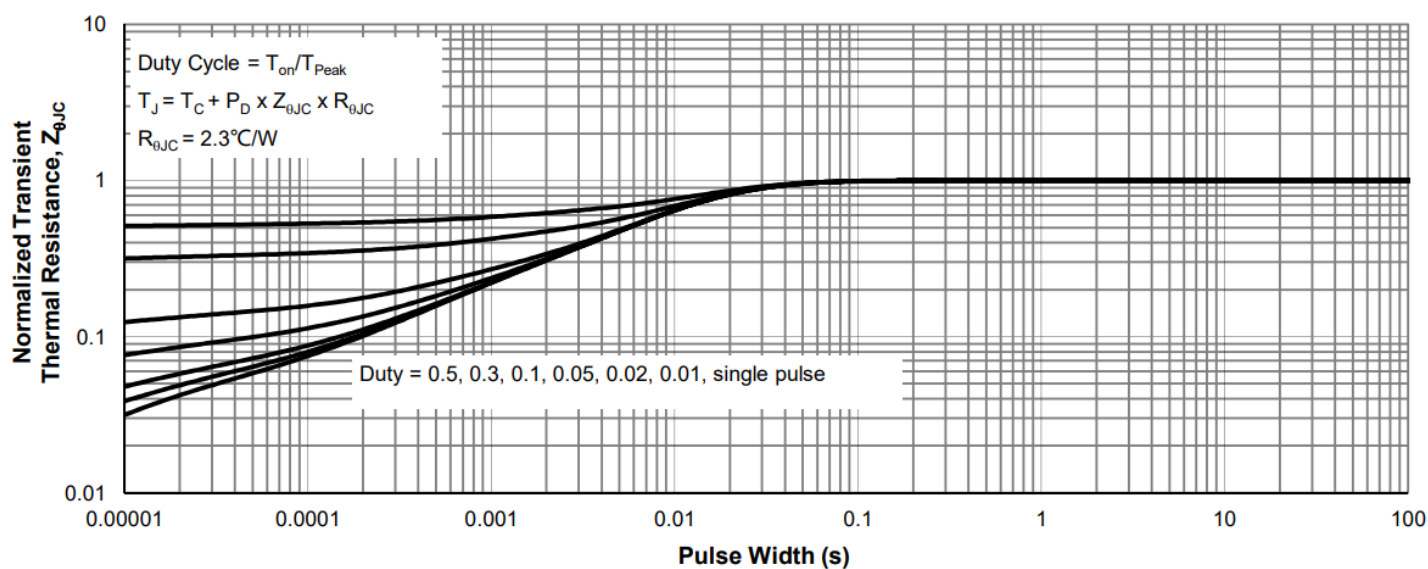
$$P_{tot}=f(T_C)$$

Diagram 2: Max. Safe Operating Area



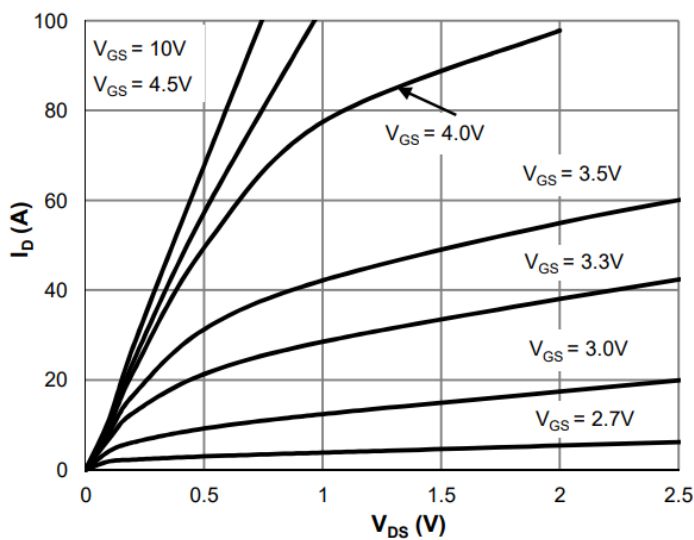
$$I_D=f(V_{DS})$$

Diagram 3: Normalized Maximum Transient Thermal Impedance



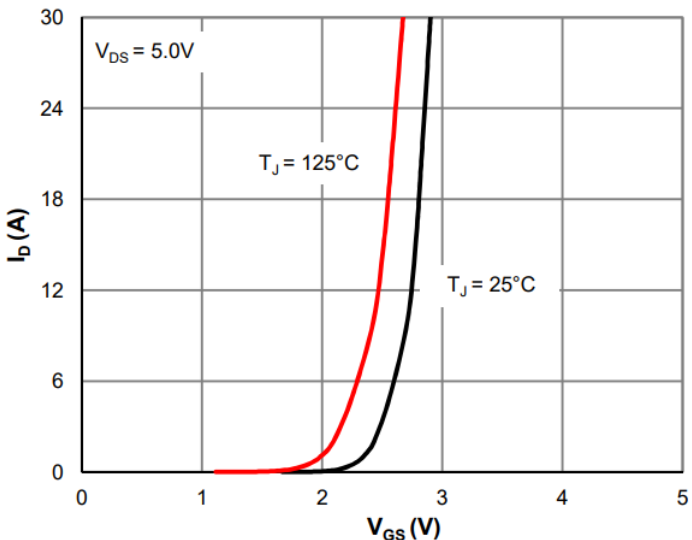
$$Z_{thJC}=f(t_p)$$

Diagram 4: Typ. output characteristics



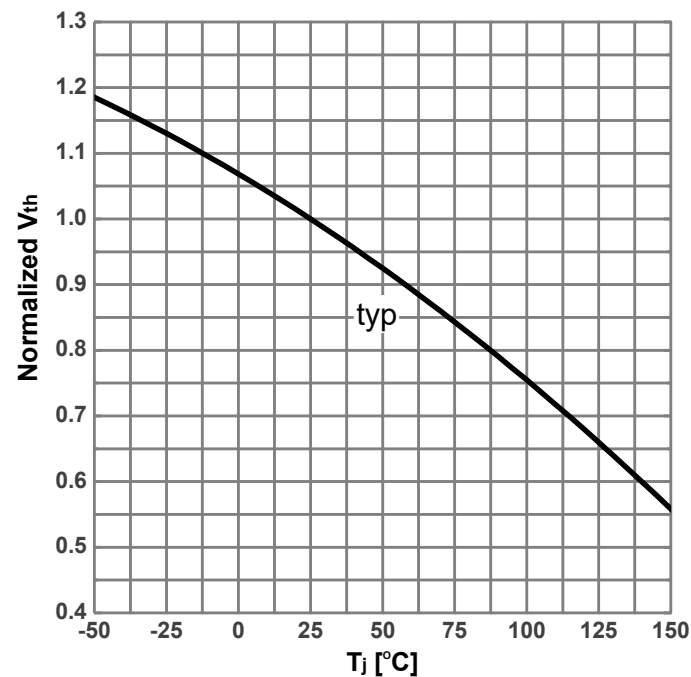
$I_D=f(V_{DS})$; $T_J=25^{\circ}\text{C}$; parameter: V_{GS}

Diagram 5: Typ. transfer characteristics



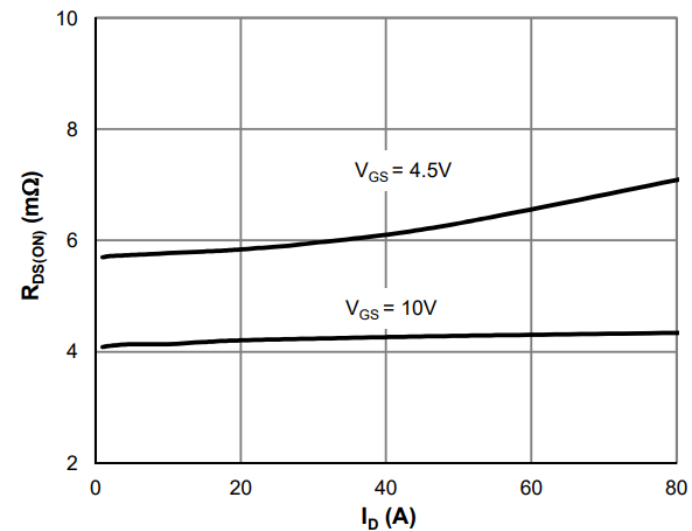
$I_D=f(V_{GS})$; $V_{DS}=5\text{V}$; parameter: T_J

Diagram 6: Gate threshold voltage vs. Junction temperature

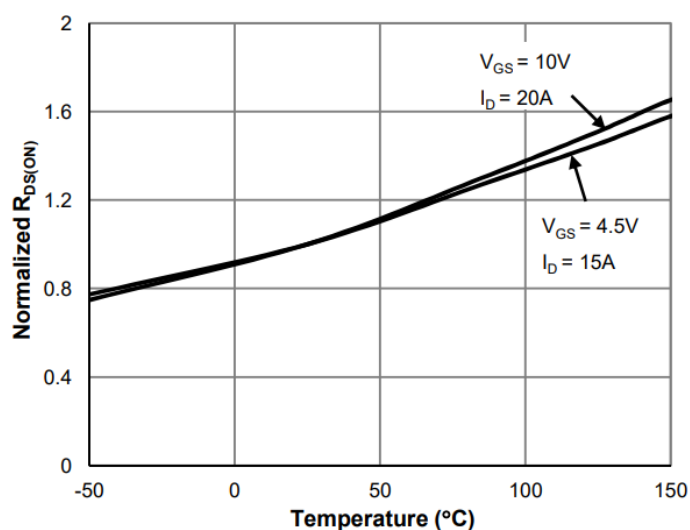


$V_{th}=f(T_J)$; $I_D=250\mu\text{A}$

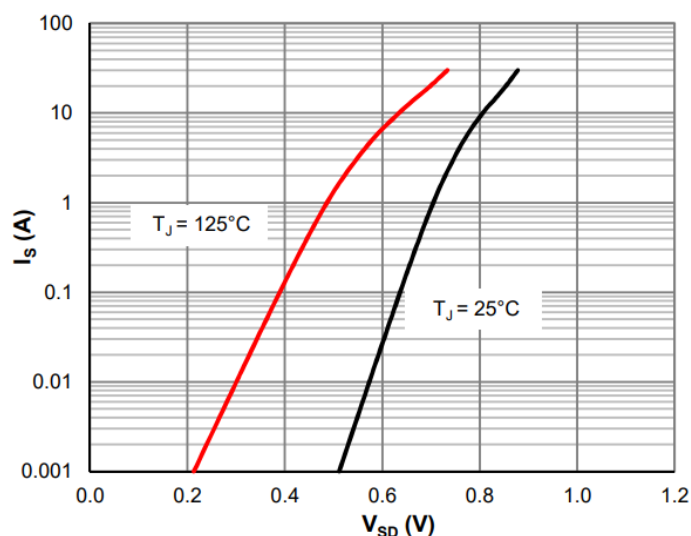
Diagram 7: On-state resistance vs. Drain current



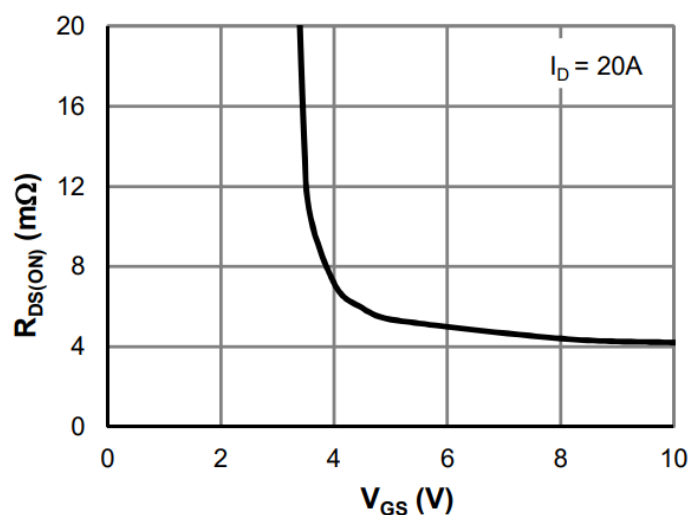
$R_{DS(on)}=f(I_D)$; $T_J=25^{\circ}\text{C}$; parameter: V_{GS}

Diagram 8: On-state resistance vs. Junction temperature

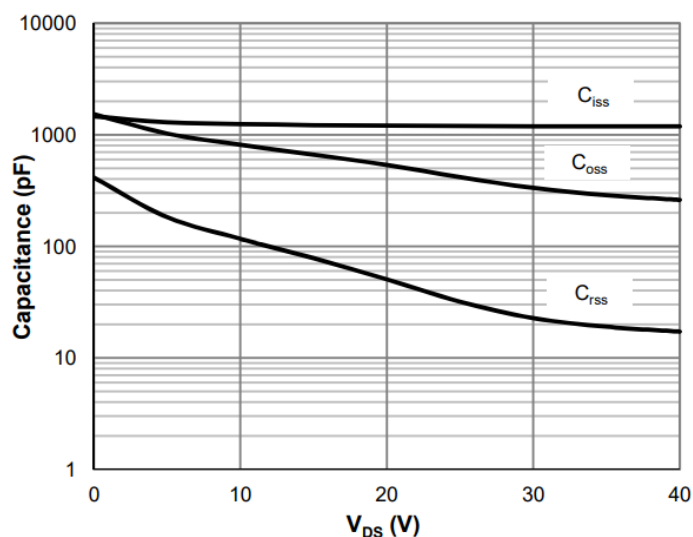
$$R_{DS(on)} = f(T_j)$$

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

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

Diagram 11: Typ. capacitances

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

Diagram 12: Maximum Drain Current

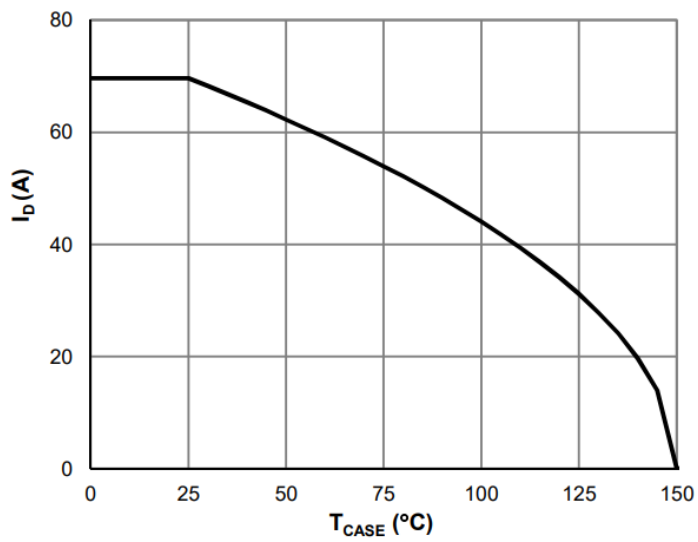
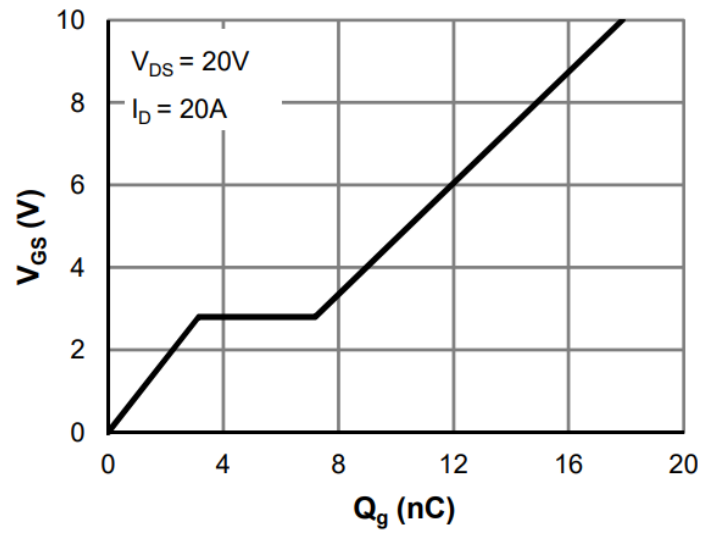

 $I_D = f(T_C); V_{GS} = 10V$

Diagram 13: Typ. gate charge


 $V_{GS} = f(Q_{gate}); I_D = 20A \text{ pulsed}; V_{DS} = 20V$

6. Test Circuits

Table 7. Diode Characteristics

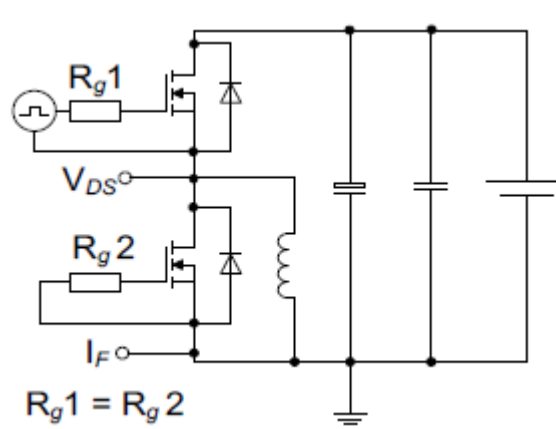
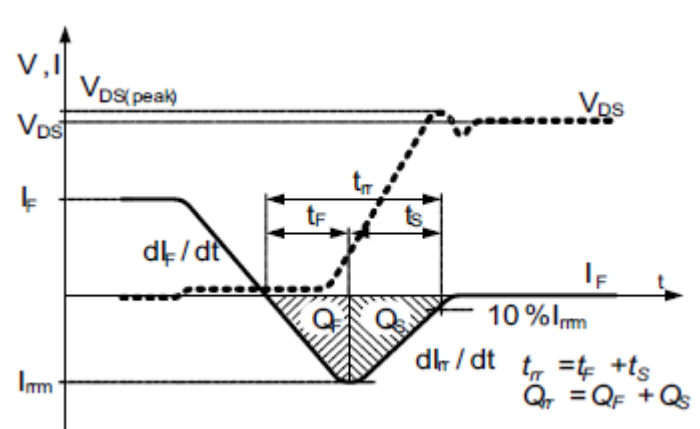
Test circuit for diode characteristics	Diode recovery waveform
	

Table 8. Switching Times

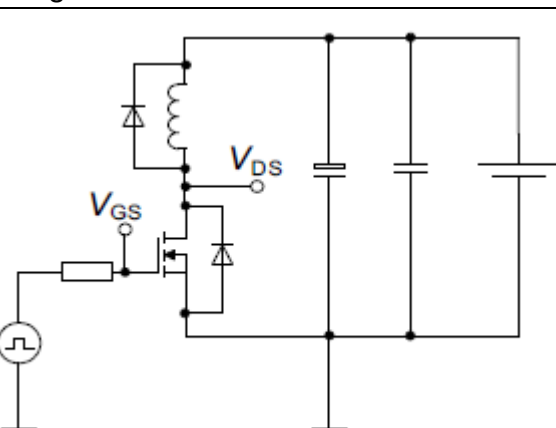
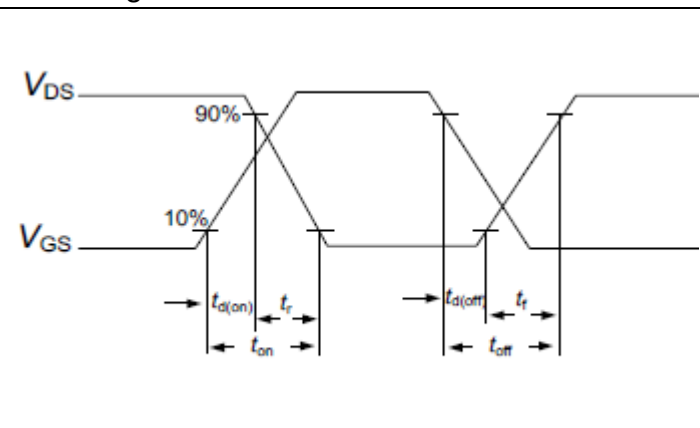
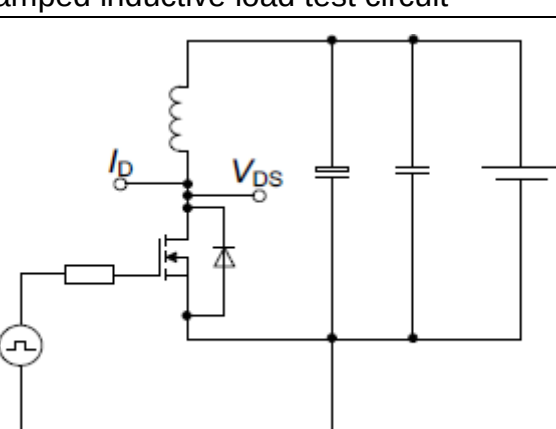
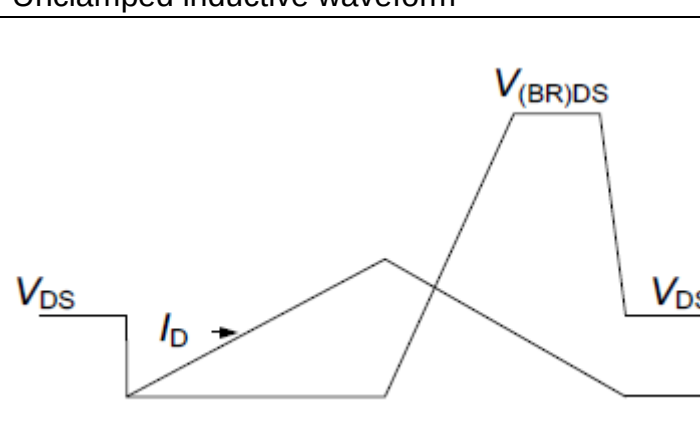
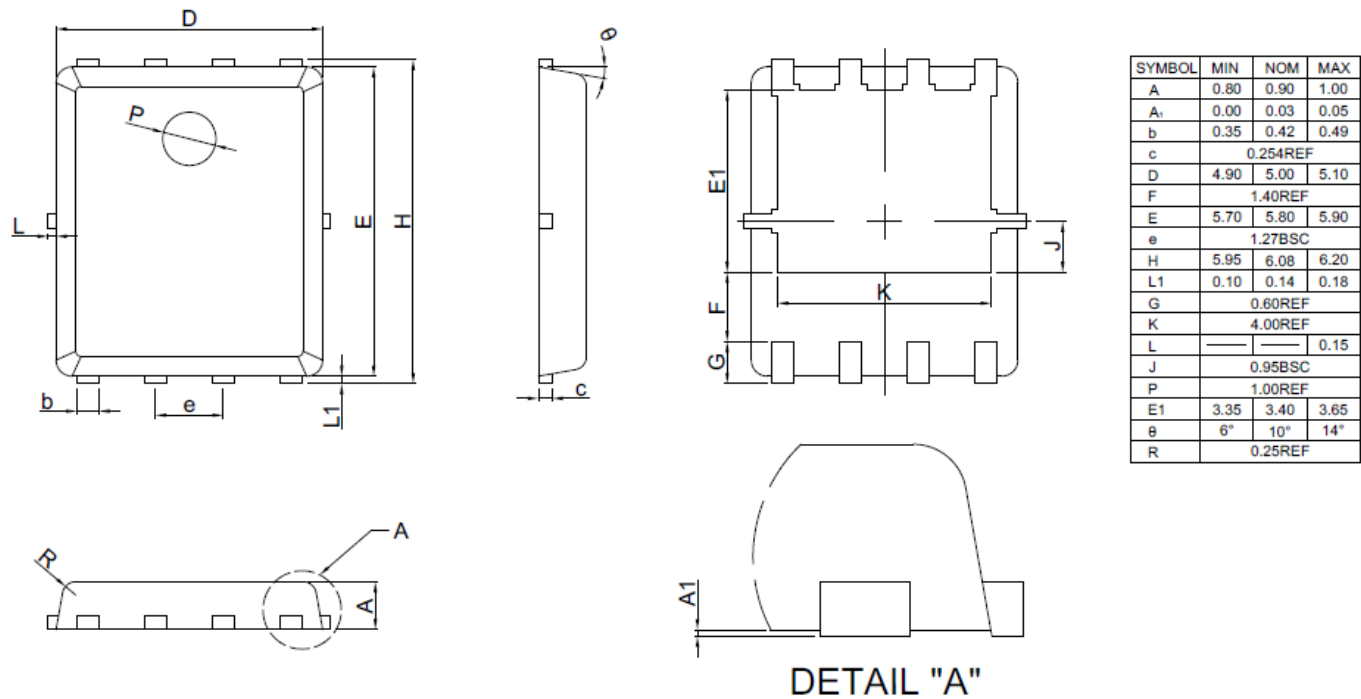
Switching times test circuit for inductive load	Switching times waveform
	

Table 9. Unclamped Inductive Load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

7. Package Outlines

Figure 1 Outline PDFN5*6 Dimensions in mm



8. Appendix

CoolSemi Webpage: www.coolsemi.com.