N-channel 600V, 26mΩ typ.,
Super Junction MOSFET G1 in TO-247

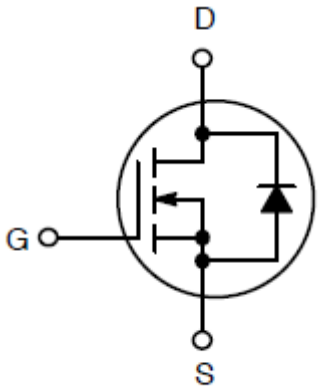
Datasheet - production data

1. Descriptions

TO-247

G D S

N-Channel MOSFET



POWER MOSFET

Key Performance Parameters

Parameters	Value	Unit
BV_{DSS}	600	V
$R_{DS(on),max}$	30	mΩ
$Q_{g,typ}$	230	nC
$I_{D,pulse}$	290	A
E_{AS}	2160	mJ

Features

• Extremely low losses due to very low FOM Rdson*Qg and Eoss.
• Very high commutation ruggedness.
• Robust design with better EAS performance.
• Qualified for industrial grade applications according to JEDEC.

Applications

Optimized for phase-shift full-bridge (ZVS), LLC & PFC Applications–EV Charging

Type/Ordering Code	Package	Marking	Related Links
CPW60R030FD1	TO-247	60R030FD1	See Appendix A

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2. Maximum Ratings

at T_j = 25°C, unless otherwise specified

Table 1. Absolute Maximum Ratings

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
V_{DS}	Drain-source voltage[1]	-	-	600	V	V_{GS}=0V, I_D=1mA
I_D	Continuous drain current[2]	- -	- -	100 45	A	T_C=25°C T_C=125°C
$I_{D,pulse}$	Pulsed drain current	-	-	290	A	T_C=25°C
E_{AS}	Avalanche energy, single pulse[3]	-	-	2160	mJ	I_D=12A; V_{DD}=50V
I_{AR}	Avalanche current, repetitive	-	-	12	A	-
dv/dt	MOSFET dv/dt ruggedness	-	-	50	V/ns	V_{DS}=0...480V
V_{GS}	Gate source voltage	-30	-	30	V	static; AC (f>1 Hz)
P_{tot}	Power dissipation TO-247	-	-	625	W	T_C=25°C
T_j, T_{stg}	Operating and storage temperature	-55	-	150	°C	-
I_S	Continuous diode forward current	-	-	100	A	T_C=25°C
$I_{S,pulse}$	Diode pulse current[2]	-	-	290	A	T_C=25°C
dv/dt	Reverse diode dv/dt[4]	-	-	50	V/ns	V_{DS}=0...400V, I_{SD}<=I_S, T_j=25°C
di_f/dt	Maximum diode commutation speed[4]	-	-	500	A/µs	V_{DS}=0...400V, I_{SD}<=I_S, T_j=25°C

1) Limited by T_j max. Maximum duty cycle D=0.75.
2) Pulse width t_p limited by T_j,max.
3) V_{DD}=50V, L=30mH, R_G=25Ω, Starting T_j=25°C.
4) V_{DClink}=400V; $V_{DS,peak}$<$V_{(BR)DSS}$; identical low side and high side switch with identical R_G.

3. Thermal Characteristics

Table 2. Thermal Characteristics TO-247

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
R_{thJC}	Thermal resistance, junction - case	-	-	0.2	°C/W	T_C = 25°C
R_{thJA}	Thermal resistance, junction - ambient	-	-	62	°C/W	T_C = 25°C
T_{sold}	Soldering temperature, wavesoldering only allowed at leads	-	-	260	°C	Lead Temperature (Soldering, 10 sec)

4. Electrical Characteristics

at T_j = 25°C, unless otherwise specified

Table 3. Static Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-source breakdown voltage	600	-	-	V	V_{GS}=0V, I_D=1mA
$V_{(GS)th}$	Gate threshold voltage	3.0	-	4.5	V	V_{DS}=V_{GS}, I_D=2mA
I_{DSS}	Zero gate voltage drain current	-	-	10	μA	V_{DS}=600V, V_{GS}=0V, T_j=25°C
I_{GSS}	Gate-source leakage current	-	-	±100	nA	V_{GS}=±30V, V_{DS}=0V
$R_{DS(on)}$	Drain-source on-state resistance	-	26 61	30 70	mΩ	V_{GS}=10V, I_D=40A, T_j=25°C V_{GS}=10V, I_D=40A, T_j=125°C
R_G	Gate resistance	-	2.4	-	Ω	V_{DD}=0V,V_{GS}=0V,F=1MHz

Table 4. Dynamic Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
C_{iss}	Input capacitance	-	9420	-	pF	V_{GS}=0V, V_{DS}=50V, f=250kHz
C_{oss}	Output capacitance	-	619	-	pF	V_{GS}=0V, V_{DS}=50V, f=250kHz
C_{rss}	Reverse transfer capacitance	-	6.42	-	pF	V_{GS}=0V, V_{DS}=50V, f=250kHz
$C_{o(er)}$	Effective output capacitance, energy related[1)]	-	349	-	pF	V_{GS}=0V, V_{DS}=0 to 400V
$C_{o(tr)}$	Effective output capacitance, time related[2)]	-	1560	-	pF	V_{GS}=0V, V_{DS}=0 to 400V
$t_{d(on)}$	Turn-on delay time	-	21	-	ns	V_{DD}=400V, V_{GS}=10V, I_D=50A,
t_r	Rise time	-	30	-	ns	V_{DD}=400V, V_{GS}=10V, I_D=50A,
$t_{d(off)}$	Turn-off delay time	-	94	-	ns	V_{DD}=400V, V_{GS}=10V, I_D=50A,
t_f	Fall time	-	12	-	ns	V_{DD}=400V, V_{GS}=10V, I_D=50A,

Table 5. Gate Charge Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
Q_{gs}	Gate to source charge	-	55	-	nC	V_{DD}=480V, I_D=50A, V_{GS}=0 to 10V
Q_{gd}	Gate to drain charge	-	78	-	nC	V_{DD}=480V, I_D=50A, V_{GS}=0 to 10V
Q_g	Gate charge total	-	230	-	nC	V_{DD}=480V, I_D=50A, V_{GS}=0 to 10V
$V_{plateau}$	Gate plateau voltage	-	6.0	-	V	V_{DD}=480V, I_D=50A, V_{GS}=0 to 10V

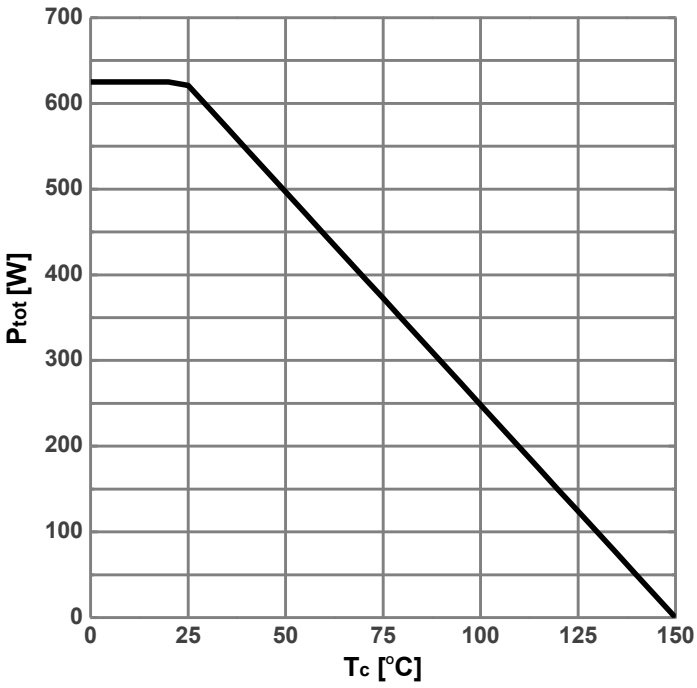
1) $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 400V.
2) $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 400V.

Table 6. Reverse Diode Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
V_{SD}	Diode forward voltage	-	0.88	-	V	V_{GS}=0V, I_F=40A, T_f=25°C
t_{rr}	Reverse recovery time	-	176	-	ns	V_R=100V, I_F=50A, di_F/dt=100A/μs
Q_{rr}	Reverse recovery charge	-	1.2	-	μC	V_R=100V, I_F=50A, di_F/dt=100A/μs
I_{rrm}	Peak reverse recovery current	-	13.5	-	A	V_R=100V, I_F=50A, di_F/dt=100A/μs

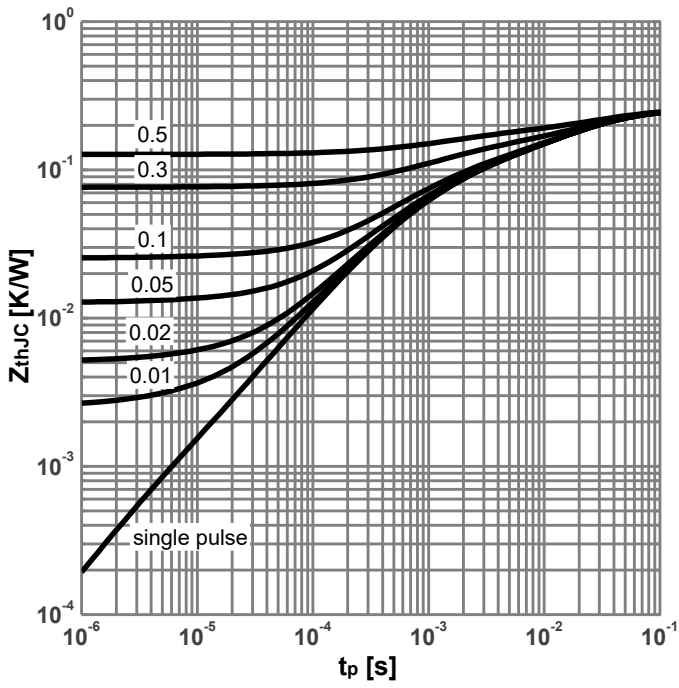
5. Electrical Characteristics Diagrams

Diagram 1: Power dissipation



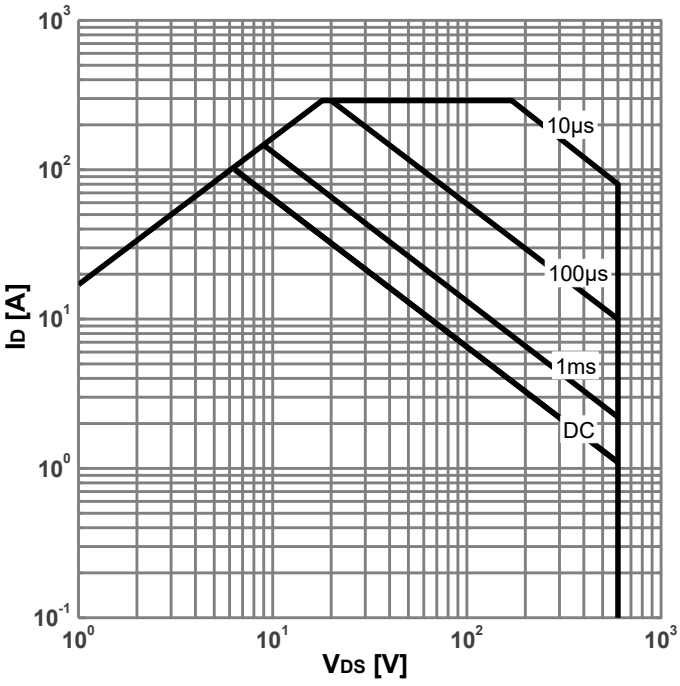
$P_{tot}=f(T_C)$

Diagram 2: Max. transient thermal impedance



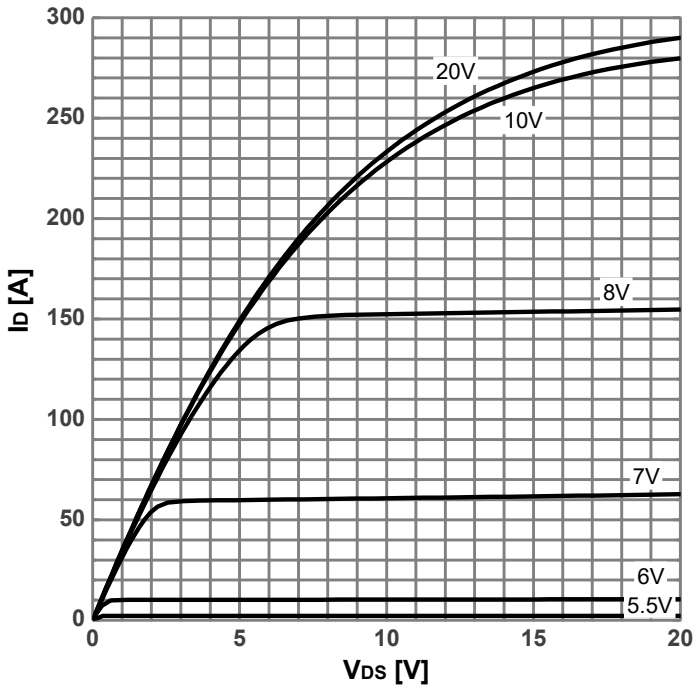
$P_{tot}=f(T_C)$

Diagram 3: Safe operating area



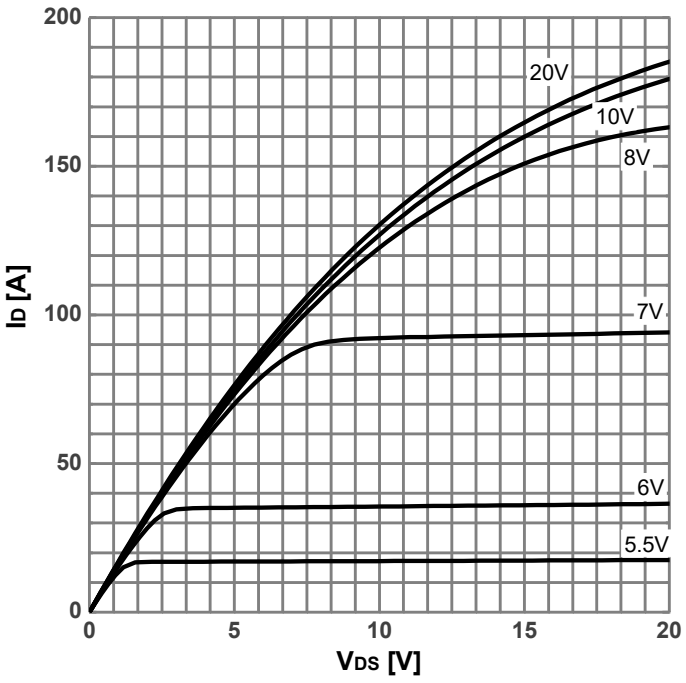
$I_D=f(V_{DS})$; T_j=25°C; D=0; parameter: t_p

Diagram 4: Typ. output characteristics



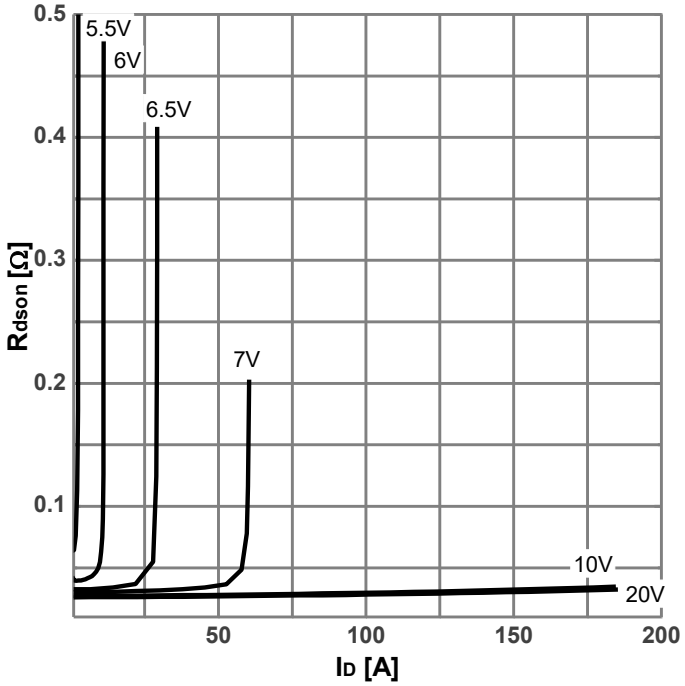
$I_D=f(V_{DS})$; T_j=25°C; parameter: V_{GS}

Diagram 5: Typ. output characteristics



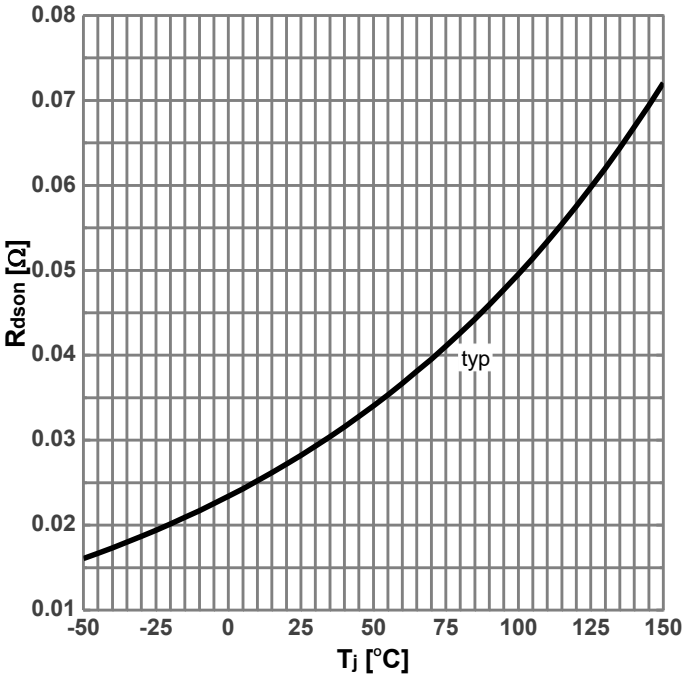
I_D=f(V_{DS}); Tj=125°C; parameter: V_{GS}

Diagram 6: Typ. drain-source on-state resistance



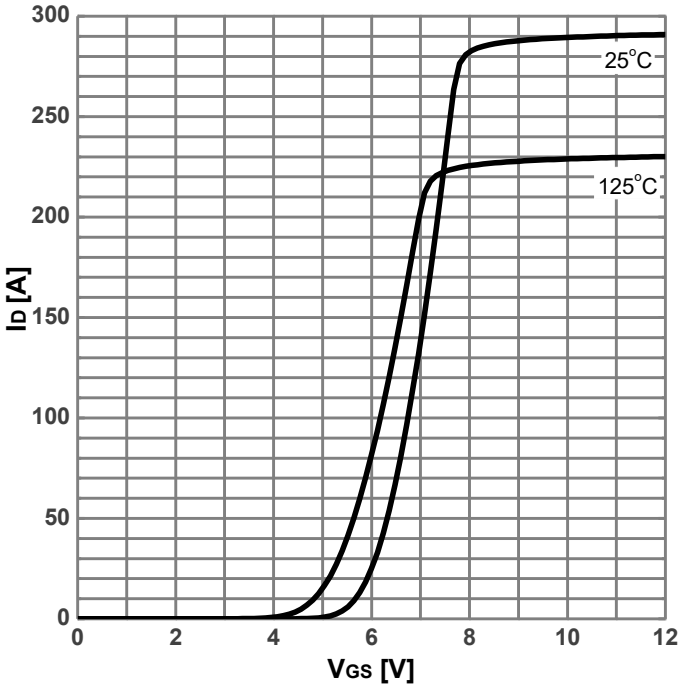
R_{DS}(on)=f(I_D); Tj=25°C; parameter: V_{GS}

Diagram 7: drain-source on-state resistance



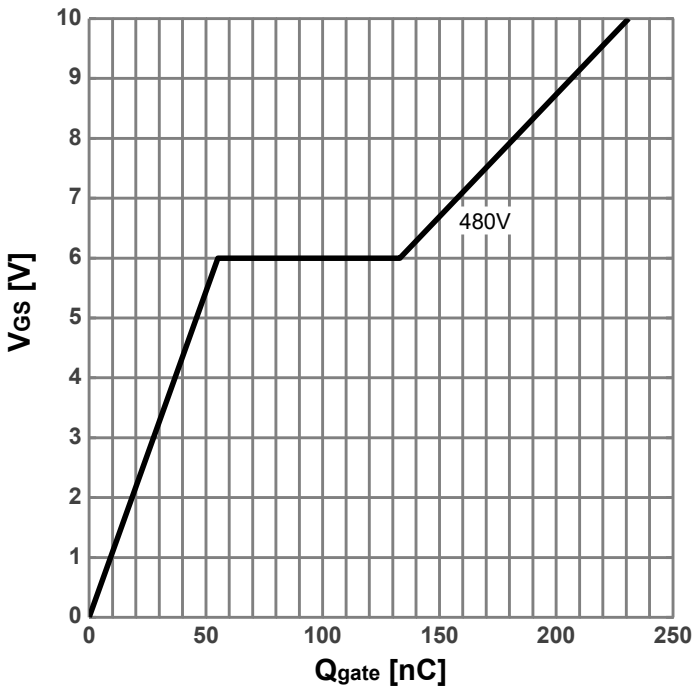
R_{DS}(on)=f(T_j); I_D=40A; V_{GS}=10V

Diagram 8: Typ. transfer characteristics



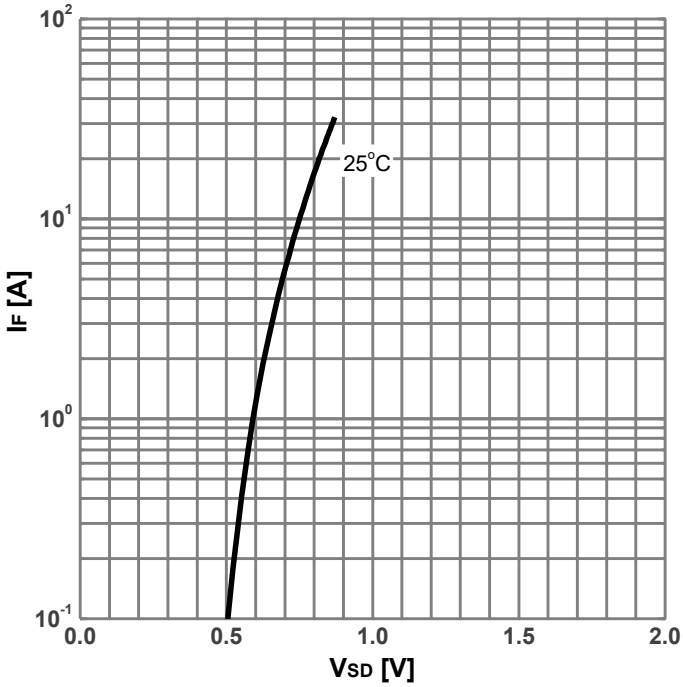
I_D=f(V_{GS}); V_{DS}=20V; parameter: T_j

Diagram 9: Typ. gate charge



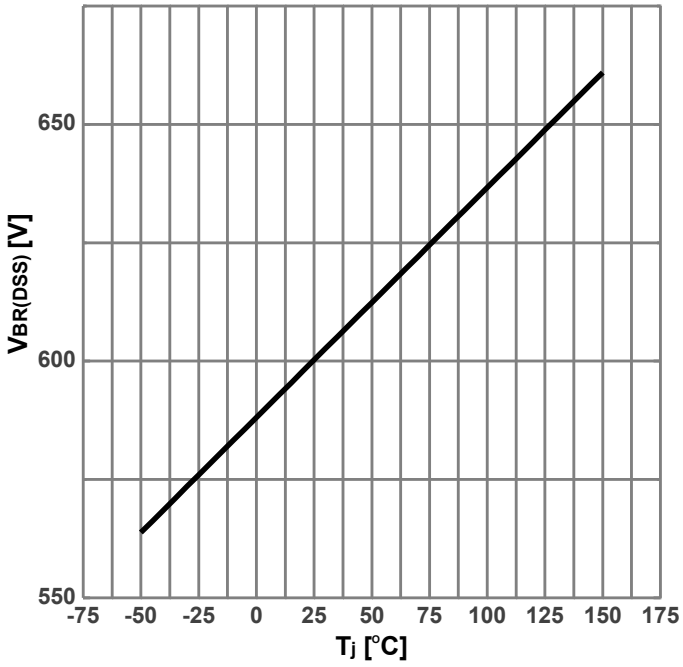
V_{GS}=f(Q_{gate}); I_D=50A pulsed; V_{DS}=480V

Diagram 10: Forward characteristics of reverse diode



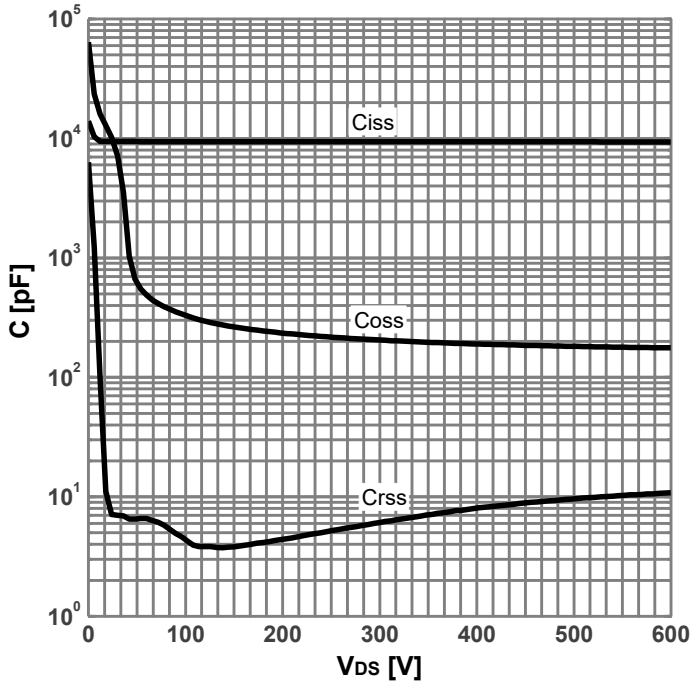
I_F=f(V_{SD}); parameter: T_j

Diagram 11: Drain-source breakdown voltage



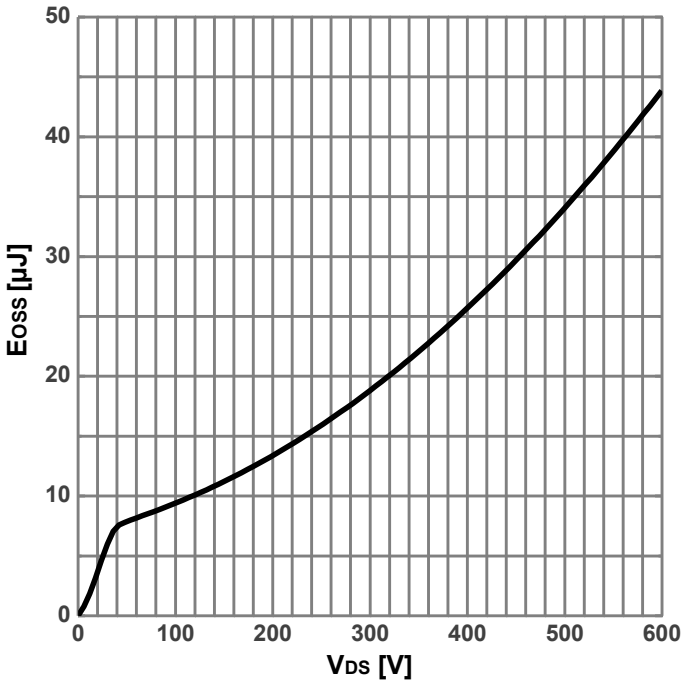
$V_{BR(DSS)}$=f(T_j); I_D=1mA

Diagram 12: Typ. capacitances



C=f(V_{DS}); V_{GS}=0V; f=250kHz

Diagram 13: Typ. Coss stored energy



E_{OSS} =f(V_{DS})

6. Test Circuits

Table 7. Diode Characteristics

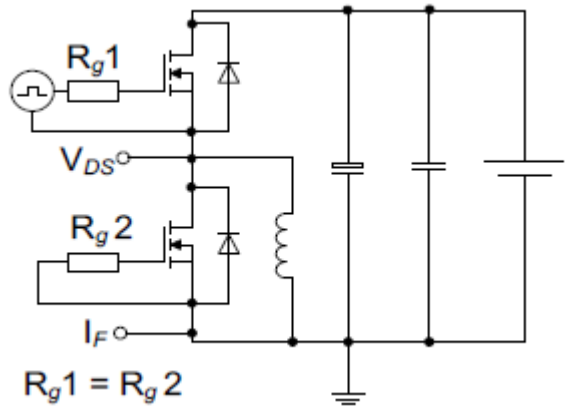
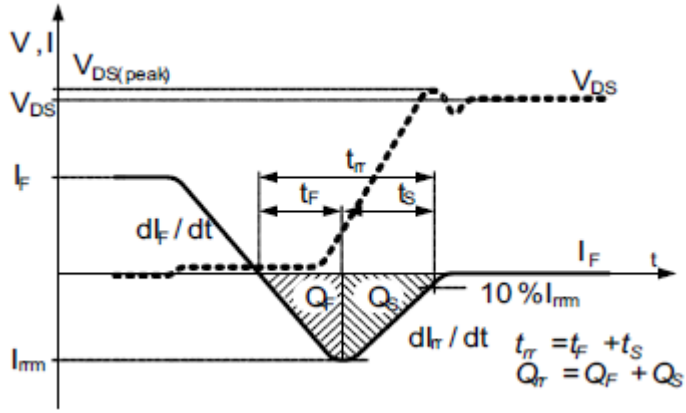
Test circuit for diode characteristics	Diode recovery waveform
	

Table 8. Switching Times

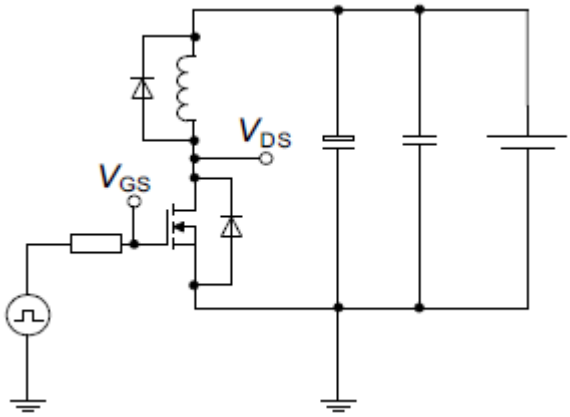
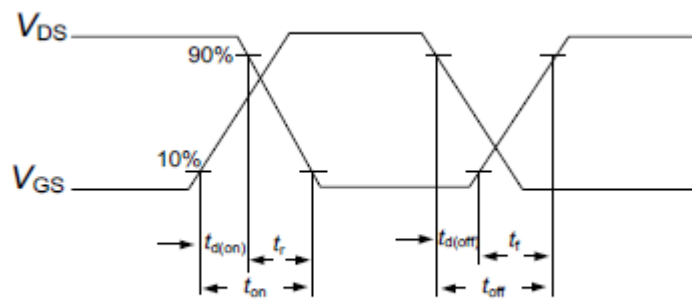
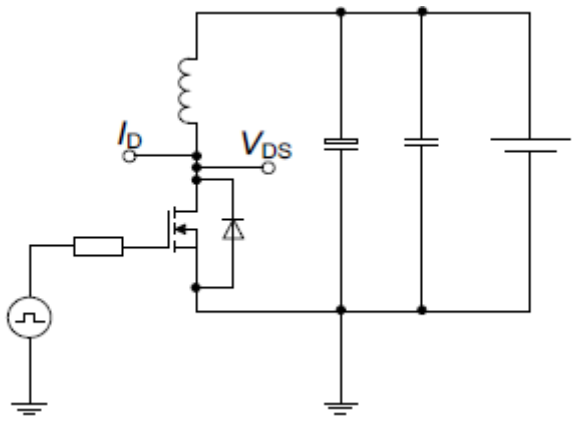
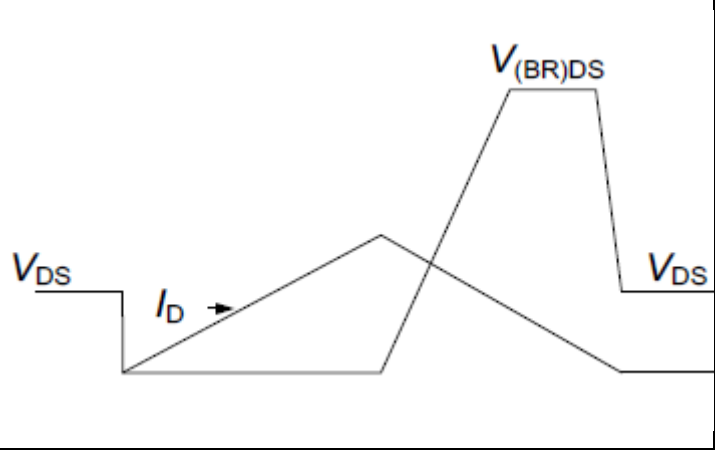
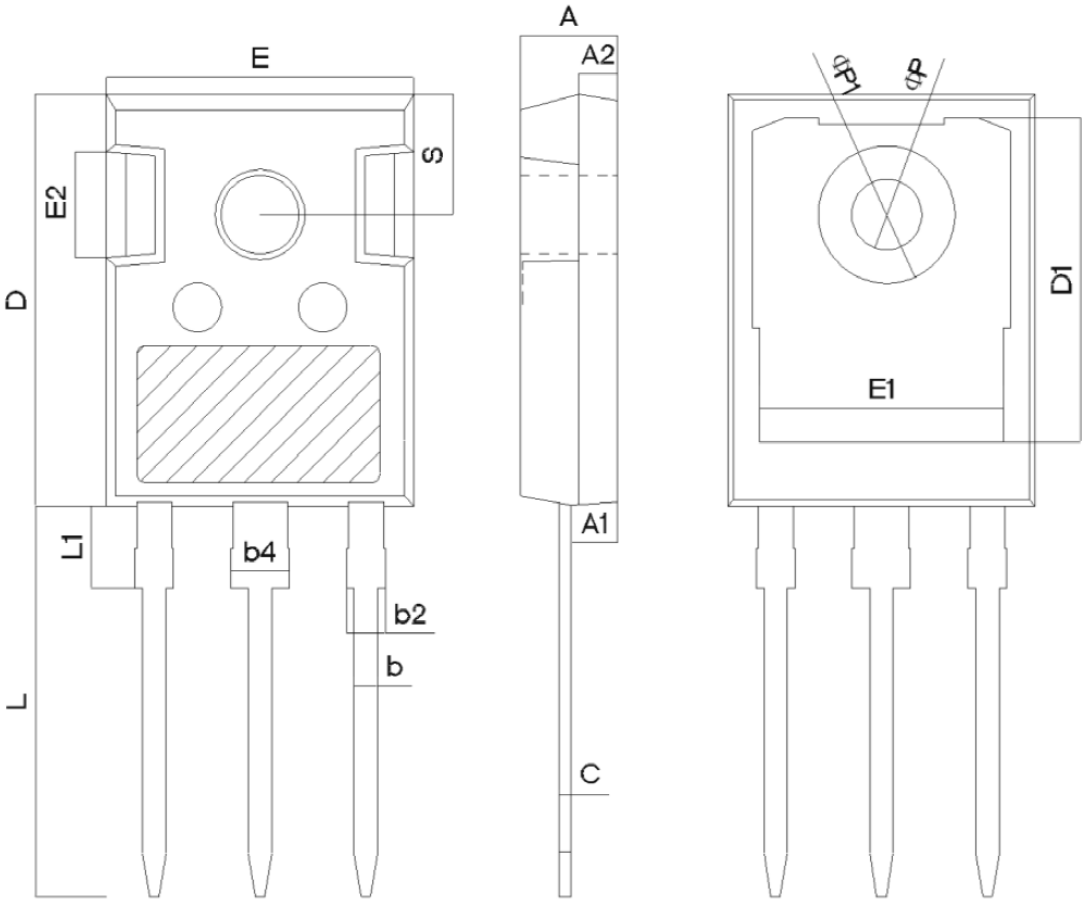
Switching times test circuit for inductive load	Switching times waveform
	

Table 9. Unclamped Inductive Load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

7. Package Outlines

Figure 1 Outline TO-247 Dimensions in mm



SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6.15BSC		

8. Appendix

CoolSemi Webpage: www.coolsemi.com.