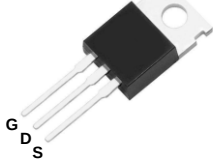
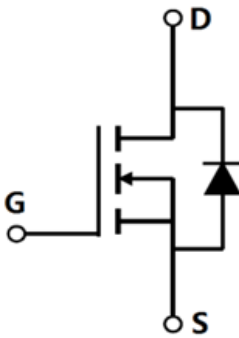


N-channel 150V, 16.5mΩ max., 70A
 SGT MOSFET S2 in TO-263, TO-220 and TO-247

Datasheet – production data

1. Descriptions

TO-263	TO-220
	
TO-247	
	
Schematic Diagram	
	

Key Performance Parameters

Parameters	Value	Unit
BV_{DSS}	150	V
$R_{DS(on),max}$	16.5	mΩ
P_D	300	W
I_D	70	A

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
CSB165N15S2A	TO-263	165N15S2A	See Appendix A
CSP165N15S2A	TO-220		
CSW165N15S2A	TO-247		

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2. Maximum Ratings

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

Absolute Maximum Ratings

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
V_{DS}	Drain-source voltage ¹⁾	-	-	150	V	$V_{GS}=0V$, $I_D=250\mu A$
V_{GS}	Gate source voltage	-20	-	20	V	static; AC ($f>1\text{ Hz}$)
I_D	Continuous drain current ²⁾	-	-	70	A	$T_C=25^\circ\text{C}$
$I_{D,pulse}$	Pulsed drain current	-	-	250	A	$T_C=25^\circ\text{C}$
P_D	Power dissipation	-	-	300	W	$T_C=25^\circ\text{C}$
E_{AS}	Avalanche energy, single pulse ³⁾	-	-	320	mJ	$I_D=36A$; $V_{DD}=50V$
T_j, T_{stg}	Operating and storage temperature	-55	-	175	$^\circ\text{C}$	-
I_S	Continuous diode forward current	-	-	70	A	$T_C=25^\circ\text{C}$
$I_{S,pulse}$	Diode pulse current ²⁾	-	-	250	A	$T_C=25^\circ\text{C}$

3. Thermal Characteristics

Thermal Characteristics (DFN5*6)

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
R_{thJC}	Thermal resistance, junction - case	-	-	0.5	$^\circ\text{C/W}$	$T_C = 25^\circ\text{C}$
R_{thJA}	Thermal resistance, junction - ambient	-	-	55	$^\circ\text{C/W}$	$T_C = 25^\circ\text{C}$
T_{sold}	Soldering temperature, wavesoldering only allowed at leads	-	-	260	$^\circ\text{C}$	Lead Temperature (Soldering, 10 sec)

4. Electrical Characteristics

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

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		

Off Characteristics

$V_{(BR)DSS}$	Drain-source breakdown voltage	150	-	-	V	$V_{GS}=0V, I_D=250\mu A$
I_{DSS}	Zero gate voltage drain current	-	-	1	μA	$V_{DS}=150V, V_{GS}=0V, T_j=25^\circ C$
I_{GSS}	Gate-source leakage current	-	-	± 100	nA	$V_{GS}=\pm 20V, V_{DS}=0V$

On Characteristics

$V_{(GS)th}$	Gate threshold voltage	2	3	4	V	$V_{DS}=V_{GS}, I_D=250\mu A$
$R_{DS(on)}$	Drain-source on-state resistance	-	13	16.5	m Ω	$V_{GS}=10V, I_D=20A, T_j=25^\circ C$
R_G	Gate resistance	-	2	-	Ω	$V_{DD}=0V, V_{GS}=0V, F=1MHz$
g_{fs}	Transconductance		56		S	$V_{DS}=5V, I_D=20A$

Dynamic Characteristics

C_{iss}	Input capacitance	-	2550	-	pF	$V_{GS}=0V, V_{DS}=75V,$ $F=250KHz$
C_{oss}	Output capacitance	-	194	-	pF	
C_{rss}	Reverse transfer capacitance	-	8.39	-	pF	

Switching Characteristics

$t_{d(on)}$	Turn-on delay time	-	21	-	ns	$V_{DD}=75V, V_{GS}=10V, I_D=30A,$ $R_G=3.3\Omega$
t_r	Turn-on rise time	-	13	-	ns	
$t_{d(off)}$	Turn-off delay time	-	9	-	ns	
t_f	Turn-off fall time	-	34	-	ns	
Q_g	Gate charge total	-	33.6	-	nC	$V_{DD}=75V, I_D=30A, V_{GS}=0 \text{ to } 10V$
Q_{gs}	Gate to source charge	-	9.3	-	nC	
Q_{gd}	Gate to drain charge	-	5.4	-	nC	

Reverse Diode Characteristics

V_{SD}	Diode forward voltage	-	-	1.2	V	$V_{GS}=0V, I_F=20A$
t_{rr}	Reverse recovery time	-	63	-	ns	$V_R=75V, I_F=20A, di_F/dt=100A/\mu s$
Q_{rr}	Reverse recovery charge	-	180	-	nC	

- 1) Limited by T_j max. Maximum duty cycle $D=0.75$.
- 2) Pulse width t_p limited by $T_{j,max}$.
- 3) $V_{DD}=50V, L=0.5mH, R_G=25\Omega$, Starting $T_j=25^\circ C$.

5. Electrical Characteristics Diagrams

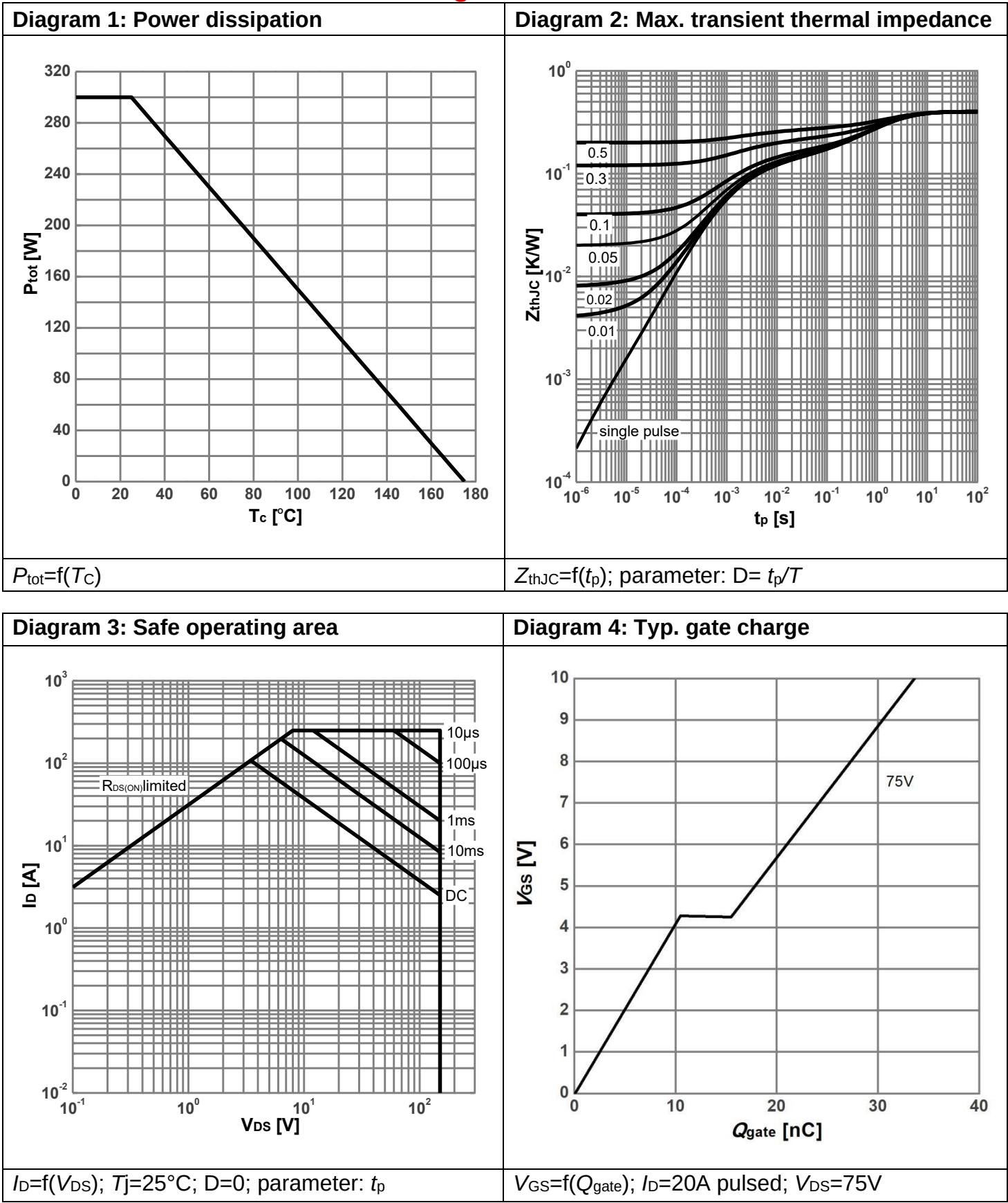
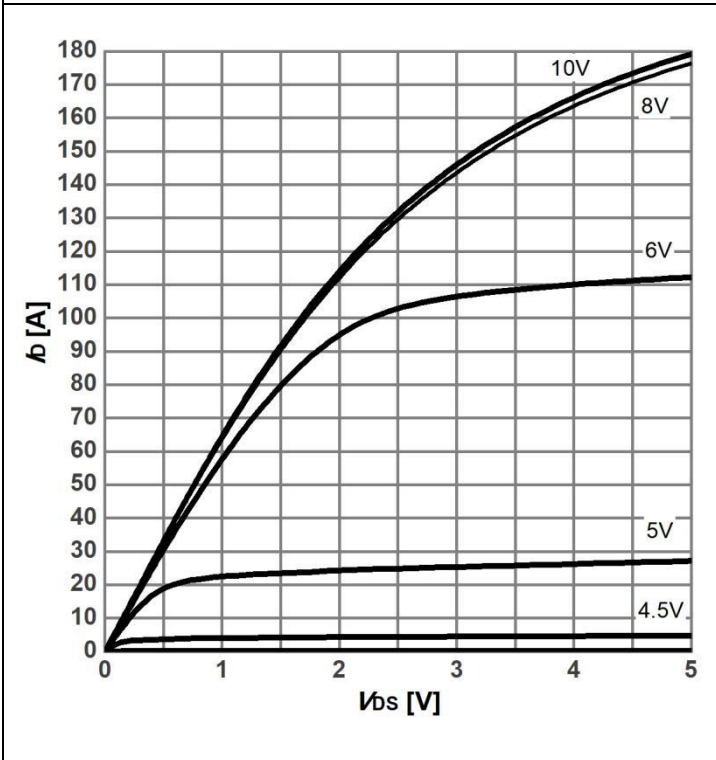
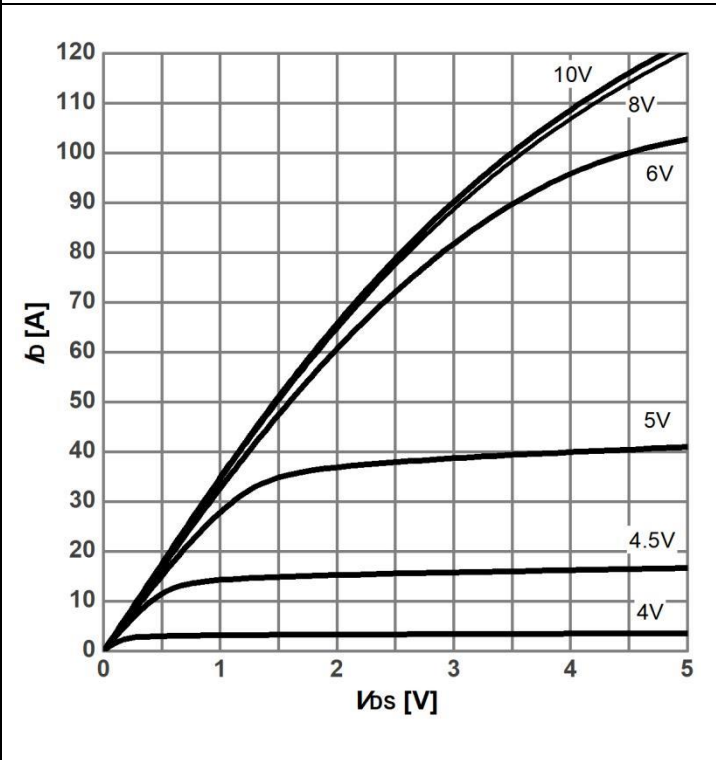


Diagram 5: Typ. output characteristics



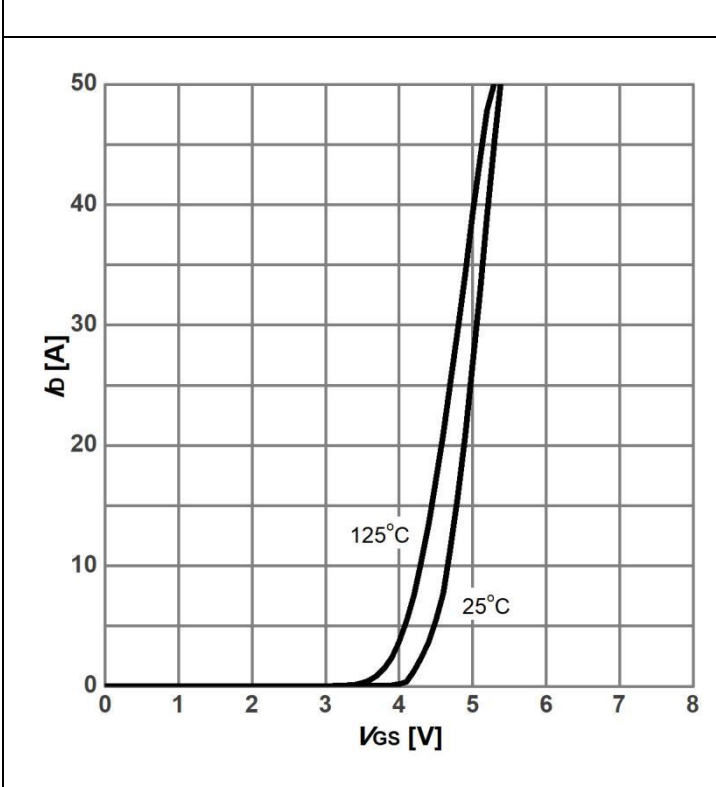
$I_D=f(V_{DS})$; $T_J=25^{\circ}\text{C}$; parameter: V_{GS}

Diagram 6: Typ. output characteristics



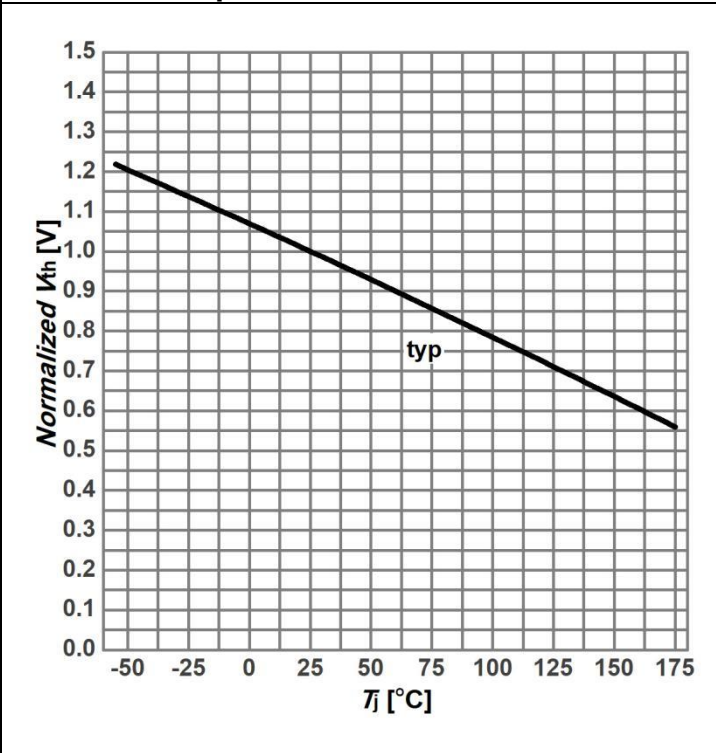
$I_D=f(V_{DS})$; $T_J=125^{\circ}\text{C}$; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



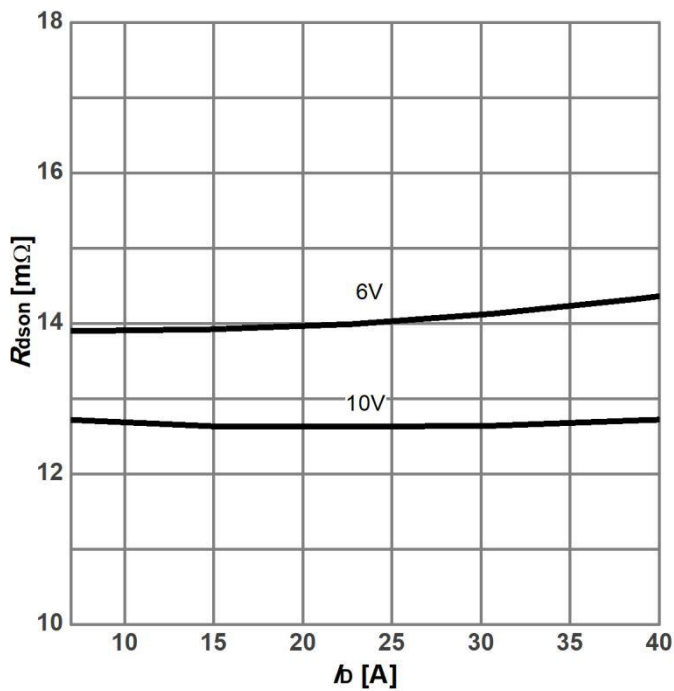
$I_D=f(V_{GS})$; $V_{DS}=5\text{V}$; parameter: T_J

Diagram 8: Gate threshold voltage vs. Junction temperature



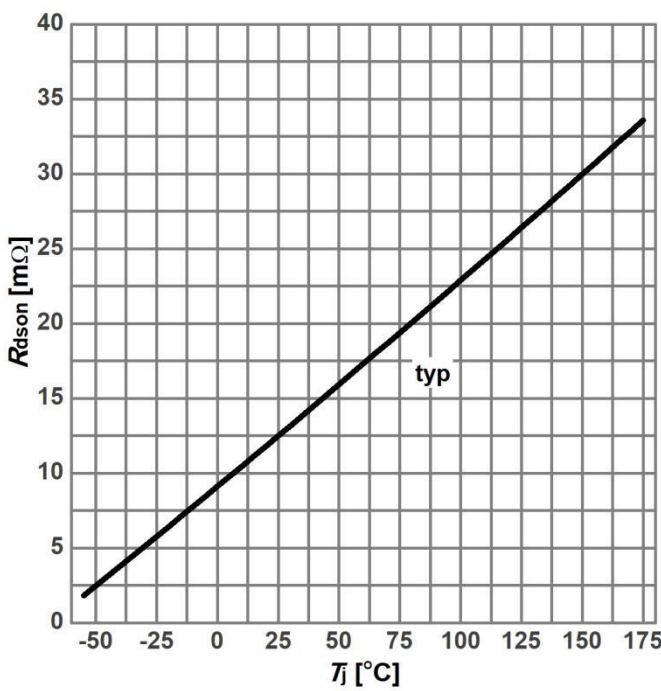
$V_{th}=f(T_J)$; $I_D=250\mu\text{A}$

Diagram 9: On-state resistance vs. Drain current



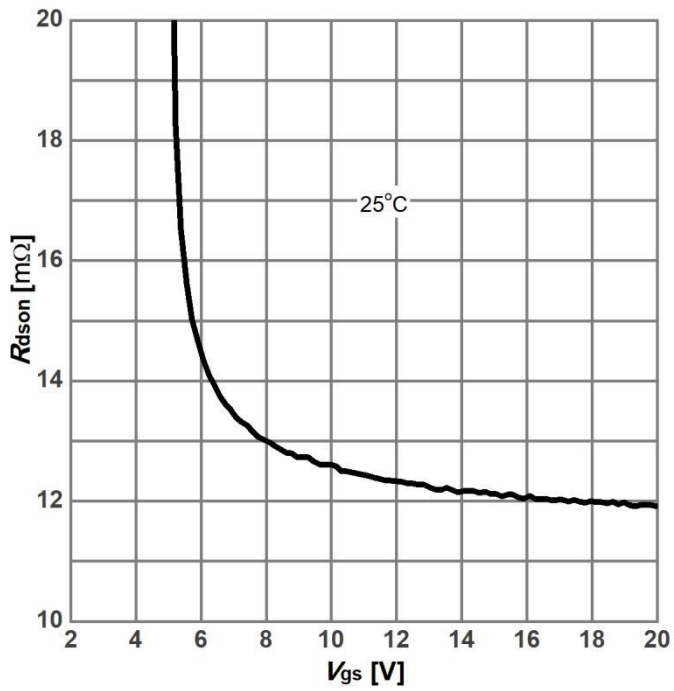
$R_{DS(on)}=f(I_D)$; $T_J=25^{\circ}C$; parameter: V_{GS}

Diagram 10: On-state resistance vs. Junction temperature



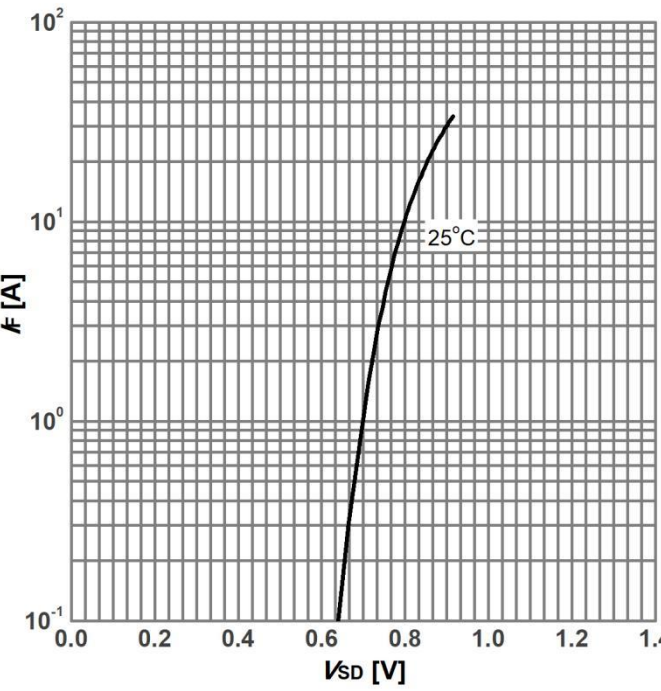
$R_{DS(on)}=f(T_J)$; $I_D=20A$; $V_{GS}=10V$

Diagram 11: On-state resistance vs. Vgs characteristics



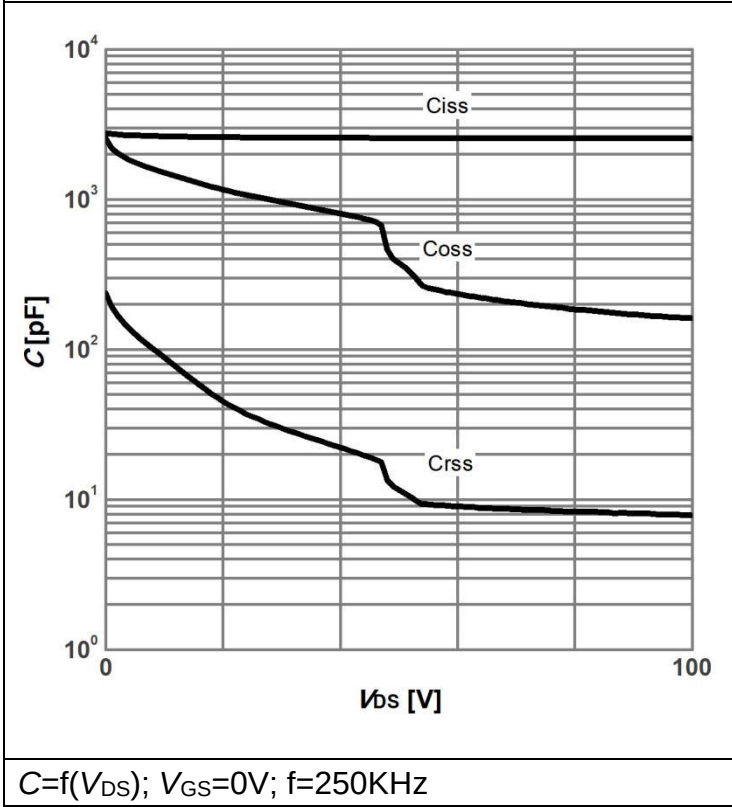
$R_{DS(on)}=f(V_{GS})$; $T_J=25^{\circ}C$; $I_D=20A$

Diagram 12: Forward characteristics of reverse diode



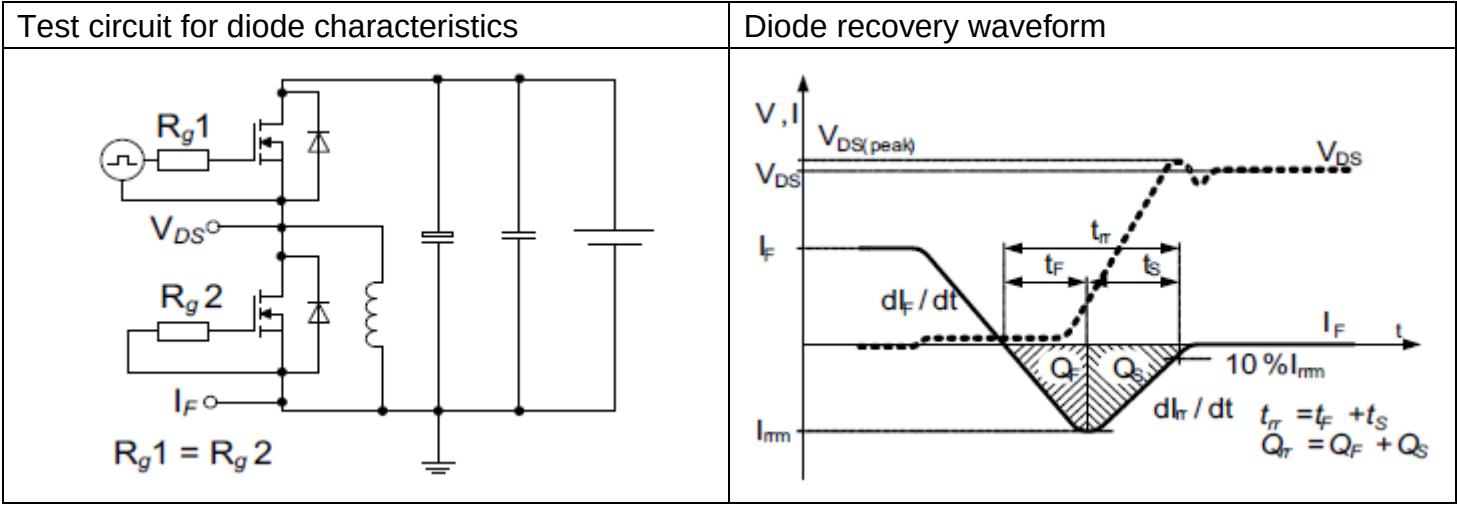
$I_F=f(V_{SD})$; $T_J=25^{\circ}C$

Diagram 13: Typ. capacitances

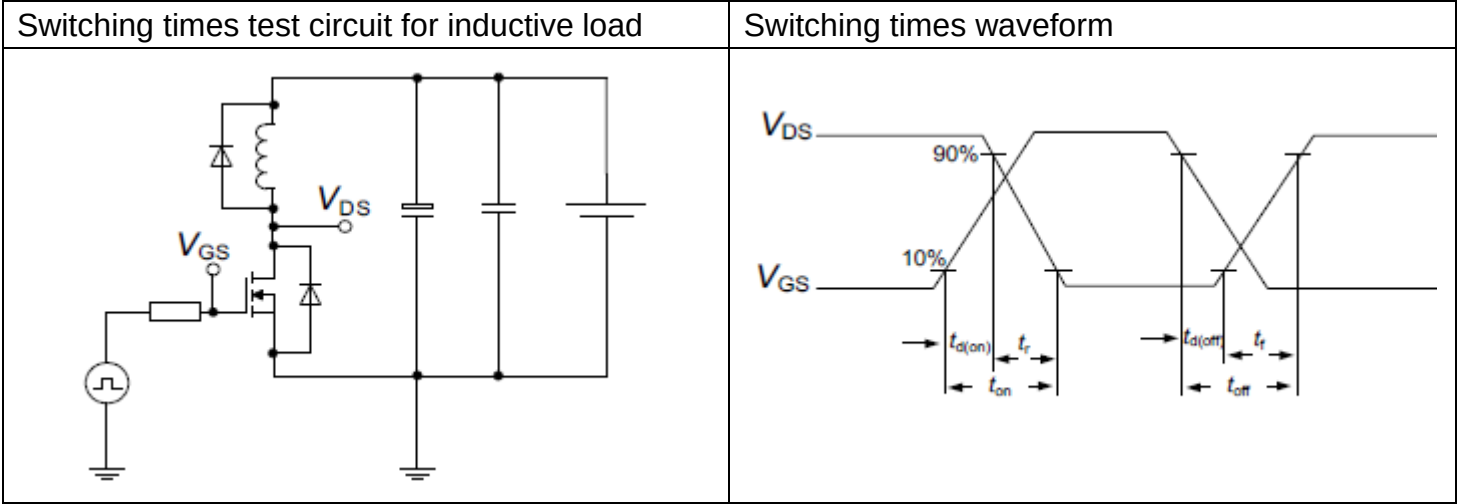


6. Test Circuits

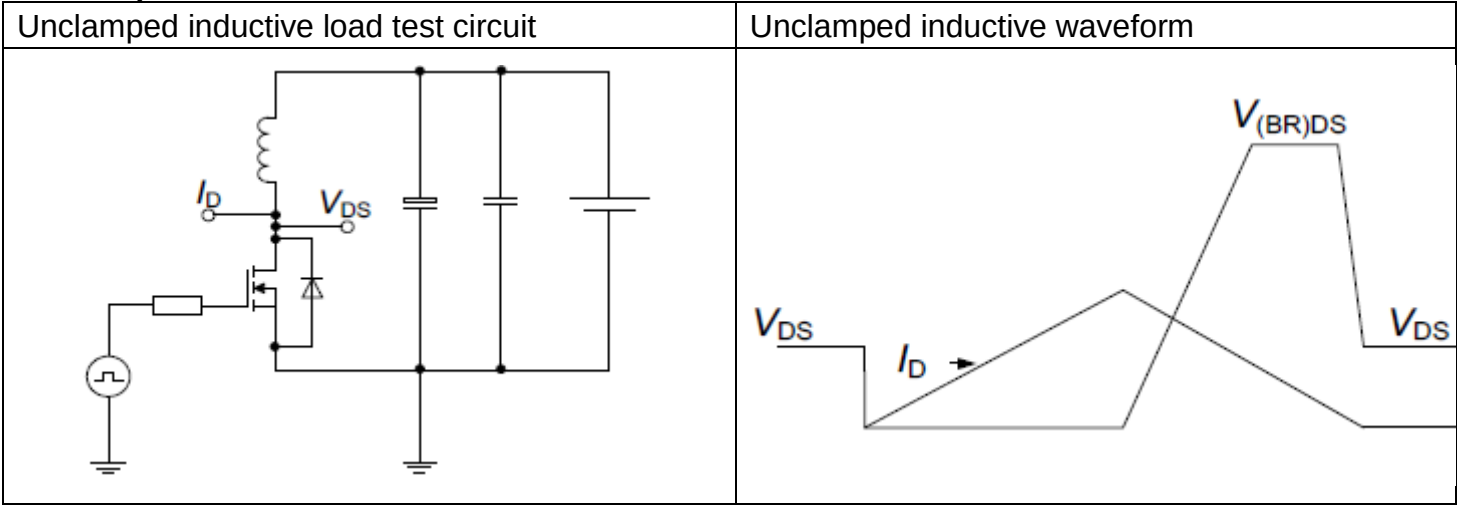
Diode Characteristics



Switching Times

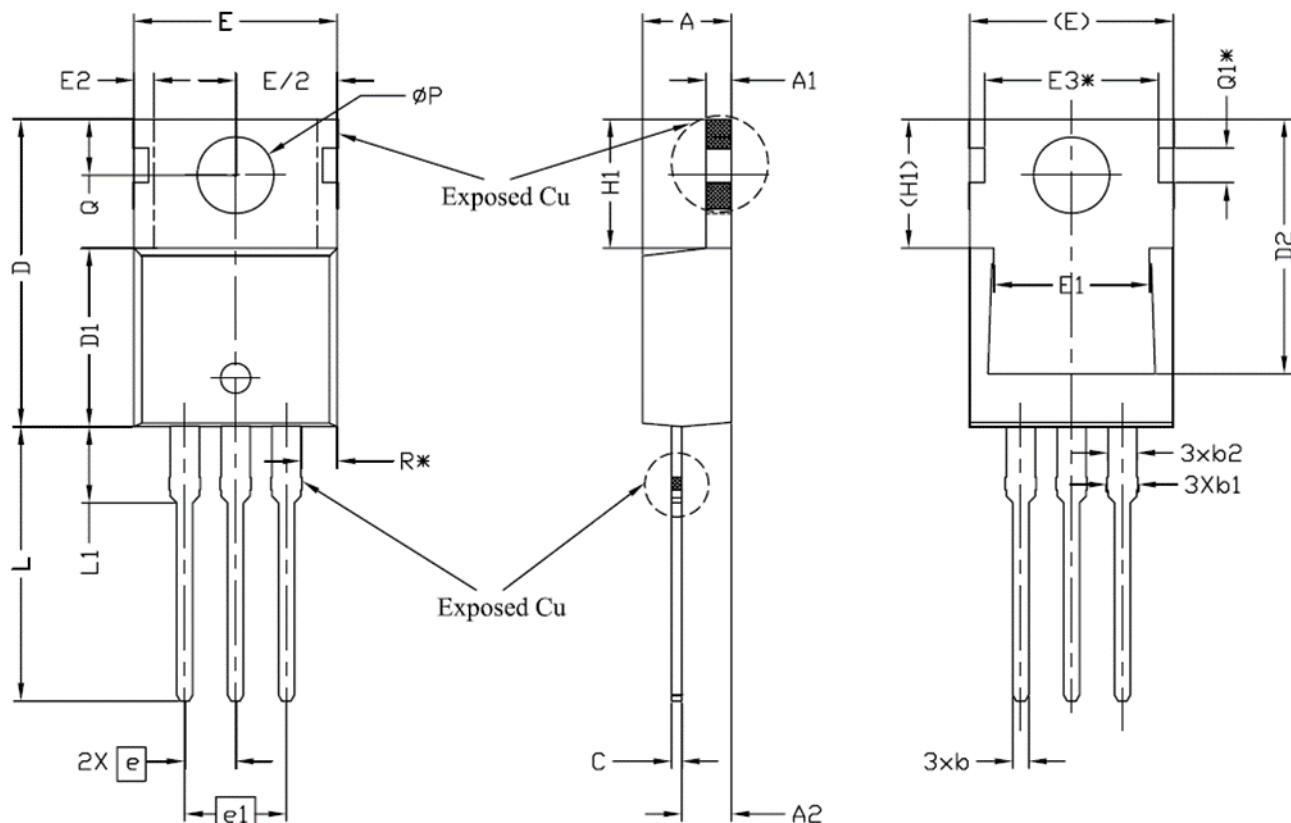


Unclamped Inductive Load



7. Package Outlines

Figure 1 Outline TO-220 Dimensions in mm



SYMBOL	DIMENSIONS			NOTES
	MIN.	NOM.	MAX.	
A	4.24	4.44	4.64	
A1	1.15	1.27	1.40	
A2	2.30	2.48	2.70	
b	0.70	0.80	0.90	
b1	1.20	1.55	1.75	
b2	1.20	1.45	1.70	
c	0.40	0.50	0.60	
D	14.70	15.37	16.00	4
D1	8.82	8.92	9.02	
D2	12.43	12.73	12.83	5
E	9.96	10.16	10.36	4,5
E1	6.86	7.77	8.89	5
E2	-	-	0.76	6
E3*	8.70REF.			
e	2.54BSC			
e1	5.08BSC			
H1	6.30	6.45	6.60	5,6
L	13.47	13.72	13.97	
L1	3.60	3.80	4.00	
øP	3.75	3.84	3.93	
Q	2.60	2.80	3.00	
Q1*	1.73REF.			
R*	1.82REF.			



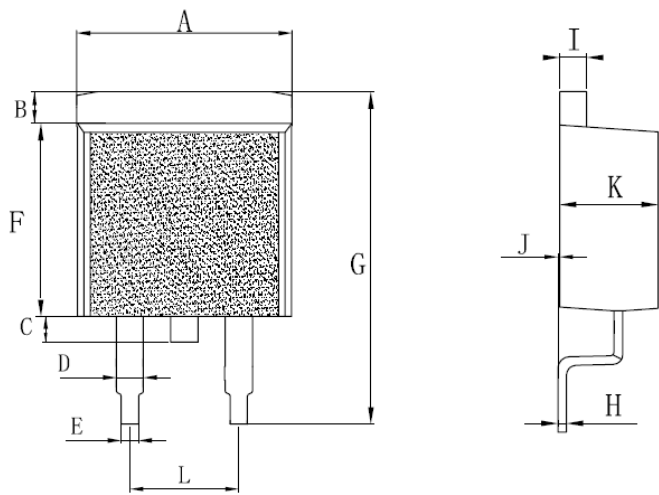
Note:

1. Package Reference: JEDEC TO220, Variation AB.
2. All Dimensions Are In mm.
3. Slot Required, Notch May Be Rounded
4. Dimension D & E Do Not Include Mold Flash. Mold Flash Shall Not Exceed 0.127mm Pre Side. These Dimensions Are Measured At The Outermost Extreme Of The Plastic Body.
5. Thermal Pad Contour Optional Within Dimensions E, H1, D2 & E1.
6. Dimension E2 & H1 Define A Zone Where Stamping And Singulation Irregularities Are Allowed.
7. "*" is reference .

Figure 2 Outline TO-263 Dimensions in mm

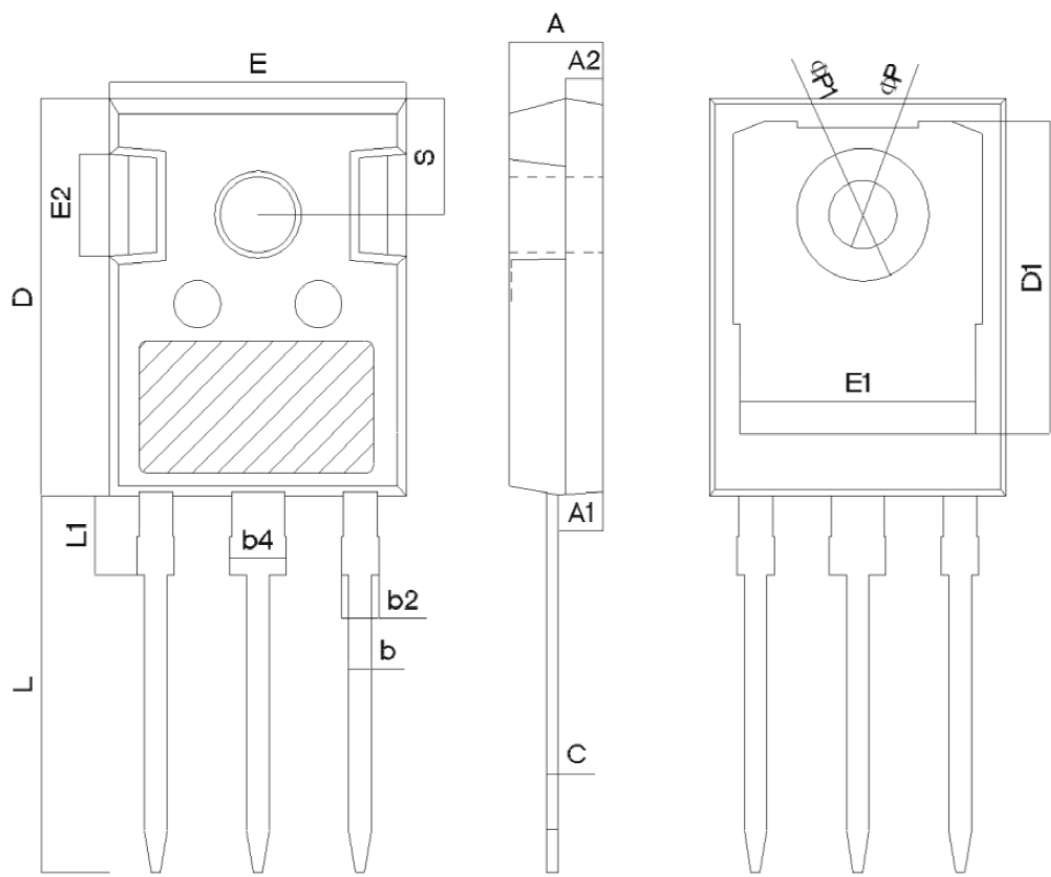
PACKAGE OUTLINE DIMENSIONS

TO-263



DIM.	Unit(mm)		Unit(inch)	
	Min	Max	Min	Max
A	9.7	10.4	0.381	0.409
B	1.31	1.62	0.051	0.063
C	0.65	1.22	0.025	0.048
D	1.15	1.36	0.045	0.053
E	0.62	0.95	0.024	0.037
F	8.75	9.32	0.344	0.366
G	14.75	15.8	0.580	0.622
H	0.32	0.48	0.012	0.018
I	1.18	1.36	0.046	0.053
J	0	0.15	0	0.005
K	4.38	4.86	0.172	0.191
L	4.85	5.23	0.190	0.205

Figure 3 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.