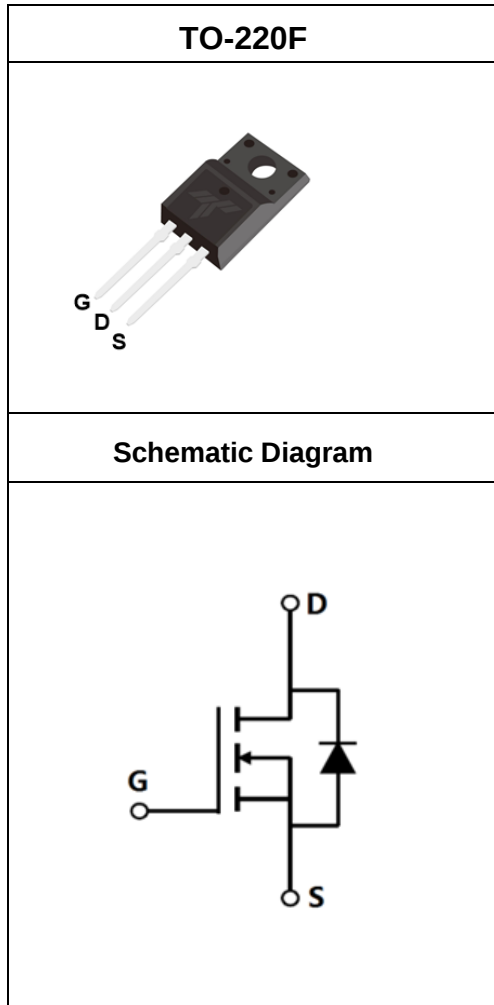


N-channel 100V, 4.2mΩ max., 65A
 SGT MOSFET S2 in TO-220F

Datasheet - production data

1. Descriptions



Key Performance Parameters

Parameters	Value	Unit
BV_{DSS}	100	V
$R_{DS(on),max}$	4.2	mΩ
$Q_{g,typ}$	56	nC
$I_{D,pulse}$	230	A
E_{AS}	625	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, Switching Voltage Regulators and Motor Drivers.

Type/Ordering Code	Package	Marking	Related Links
CSA042N10S2	TO-220F	042N10S2	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⁾	-	-	100	V	$V_{GS}=0V$, $I_D=250\mu A$
I_D	Continuous drain current	-	-	65	A	$T_C=25^\circ\text{C}$
$I_{D,pulse}$	Pulsed drain current	-	-	230	A	$T_C=25^\circ\text{C}$
E_{AS}	Avalanche energy, single pulse ²⁾	-	-	625	mJ	$I_D=50A$; $V_{DD}=50V$
I_{AS}	Avalanche current	-	-	50	A	-
V_{GS}	Gate source voltage	-20	-	20	V	static; AC ($f>1\text{ Hz}$)
P_{tot}	Power dissipation	-	-	37.5	W	$T_C=25^\circ\text{C}$
T_j, T_{stg}	Operating and storage temperature	-55	-	175	$^\circ\text{C}$	-
I_S	Continuous diode forward current	-	-	65	A	$T_C=25^\circ\text{C}$
$I_{S,pulse}$	Diode pulse current ²⁾	-	-	230	A	$T_C=25^\circ\text{C}$

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

2) $V_{DD}=50V$, $L=0.5mH$, $R_G=25\Omega$, 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	-	-	4	°C/W	$T_C = 25^{\circ}\text{C}$
R_{thJA}	Thermal resistance, junction - ambient	-	-	50	°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	100	-	-	V	$V_{GS}=0V, I_D=250\mu A$
$V_{(GS)th}$	Gate threshold voltage	2	2.8	4	V	$V_{DS}=V_{GS}, I_D=250\mu A$
I_{DSS}	Zero gate voltage drain current	-	-	1	μA	$V_{DS}=100V, V_{GS}=0V, T_j=25^\circ C$
I_{GSS}	Gate-source leakage current	-	-	± 100	nA	$V_{GS}=\pm 20V, V_{DS}=0V$
$R_{DS(on)}$	Drain-source on-state resistance	-	3.8	4.2	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		70		S	$V_{DS}=5V, I_D=20A$

Table 4. Dynamic Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
C_{iss}	Input capacitance	-	4240	-	pF	$V_{GS}=0V, V_{DS}=50V, f=250kHz$
C_{oss}	Output capacitance	-	1720	-	pF	$V_{GS}=0V, V_{DS}=50V, f=250kHz$
C_{rss}	Reverse transfer capacitance	-	29.5	-	pF	$V_{GS}=0V, V_{DS}=50V, f=250kHz$
$t_{d(on)}$	Turn-on delay time	-	24	-	ns	$V_{DD}=50V, V_{GS}=10V, I_D=20A, R_G=10\Omega$
t_r	Rise time	-	12	-	ns	$V_{DD}=50V, V_{GS}=10V, I_D=20A, R_G=10\Omega$
$t_{d(off)}$	Turn-off delay time	-	15	-	ns	$V_{DD}=50V, V_{GS}=10V, I_D=20A, R_G=10\Omega$
t_f	Fall time	-	50	-	ns	$V_{DD}=50V, V_{GS}=10V, I_D=20A, R_G=10\Omega$

Table 5. Gate Charge Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
Q_{gs}	Gate to source charge	-	14.7	-	nC	$V_{DD}=50V, I_D=20A, V_{GS}=0 \text{ to } 10V$
Q_{gd}	Gate to drain charge	-	8	-	nC	$V_{DD}=50V, I_D=20A, V_{GS}=0 \text{ to } 10V$
Q_g	Gate charge total	-	56.6	-	nC	$V_{DD}=50V, I_D=20A, V_{GS}=0 \text{ to } 10V$
$V_{plateau}$	Gate plateau voltage	-	4	-	V	$V_{DD}=50V, I_D=20A, V_{GS}=0 \text{ to } 10V$

Table 6. Reverse Diode Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
V_{SD}	Diode forward voltage	-	-	1.2	V	$V_{GS}=0V, I_F=20A, T_j=25^\circ C$
t_{rr}	Reverse recovery time	-	60	-	ns	$V_R=50V, I_F=20A, di_F/dt=100A/\mu s$
Q_{rr}	Reverse recovery charge	-	82	-	nC	$V_R=50V, I_F=20A, di_F/dt=100A/\mu s$

5. Electrical Characteristics Diagrams

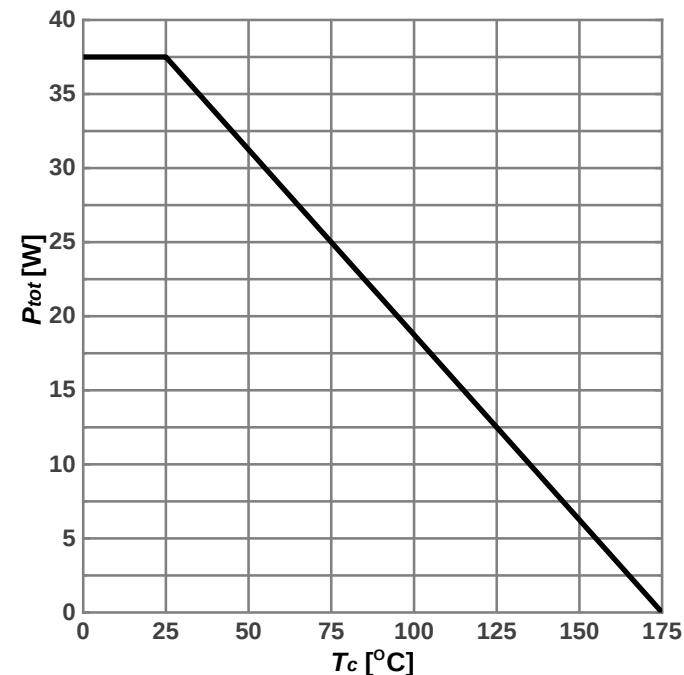
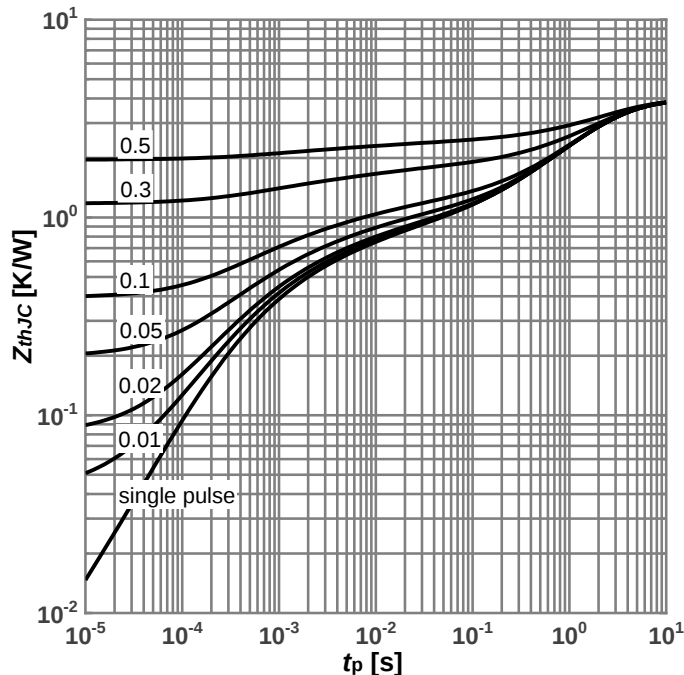
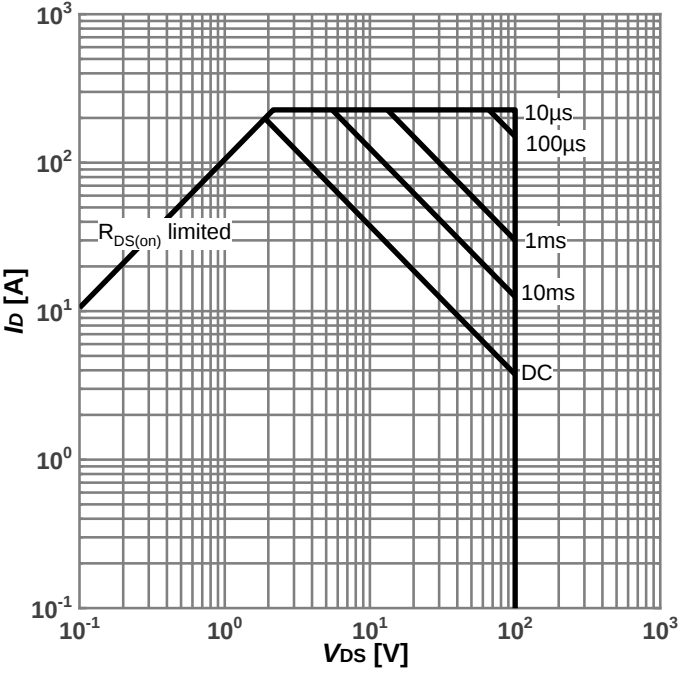
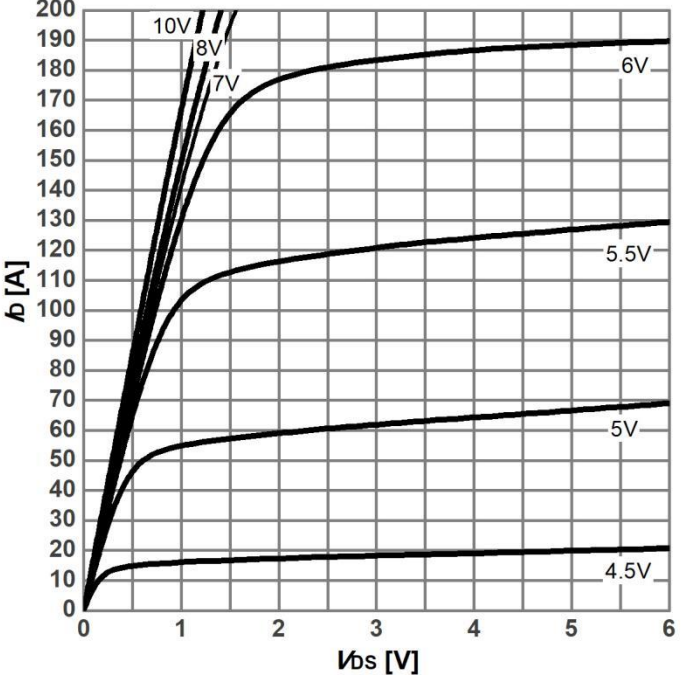
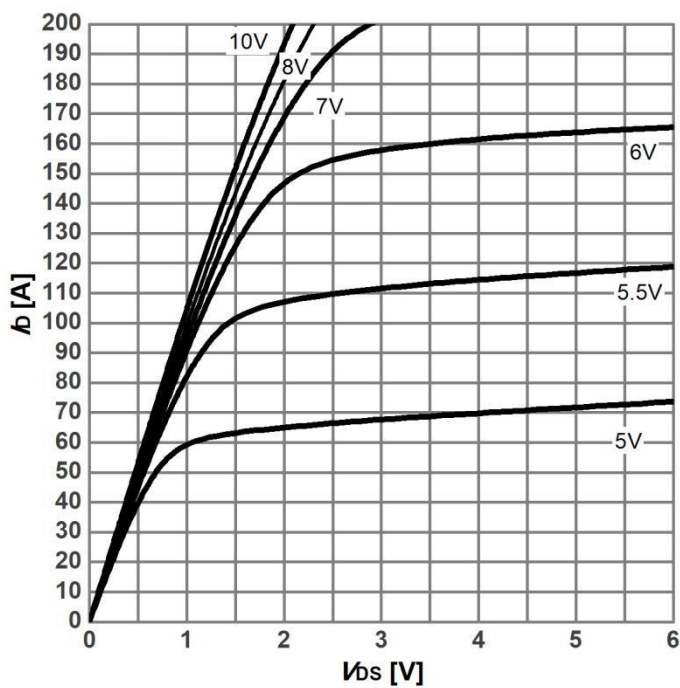
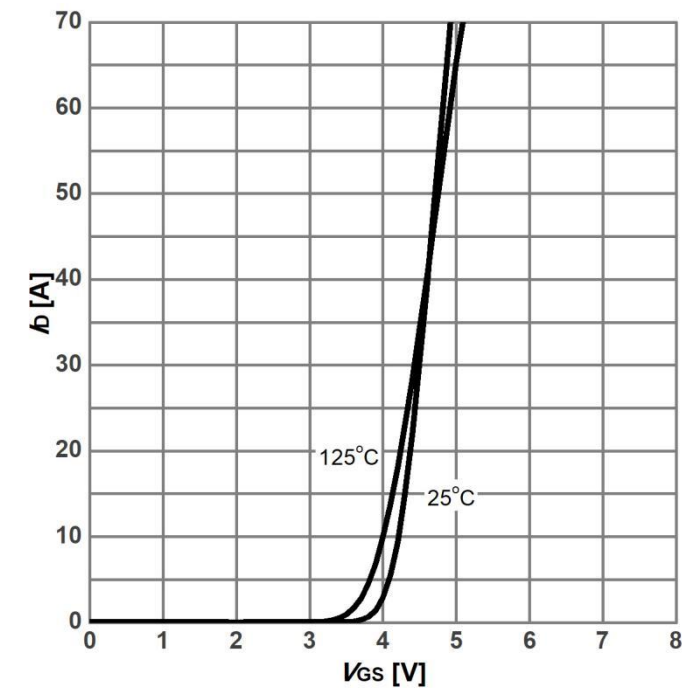
Diagram 1: Power dissipation  $P_{tot}=f(T_c)$	Diagram 2: Max. transient thermal impedance  $Z_{thJC}=f(t_p)$; parameter: $D= t_p/T$
Diagram 3: Safe operating area  $I_D=f(V_{DS})$; $T_J=25^{\circ}C$; $D=0$; parameter: t_p	Diagram 4: Typ. output characteristics  $I_D=f(V_{DS})$; $T_J=25^{\circ}C$; parameter: V_{GS}

Diagram 5: Typ. output characteristics



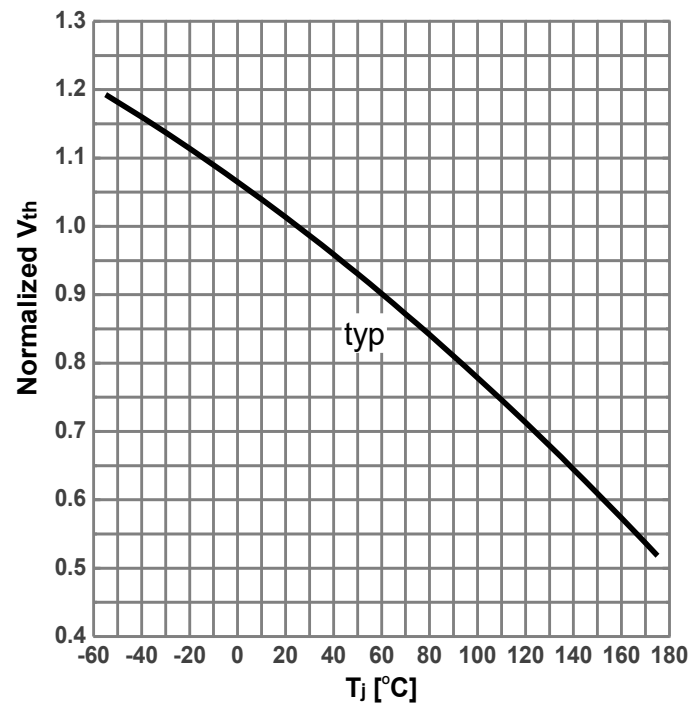
$I_D=f(V_{DS})$; $T_j=125^{\circ}\text{C}$; parameter: V_{GS}

Diagram 6: Typ. transfer characteristics



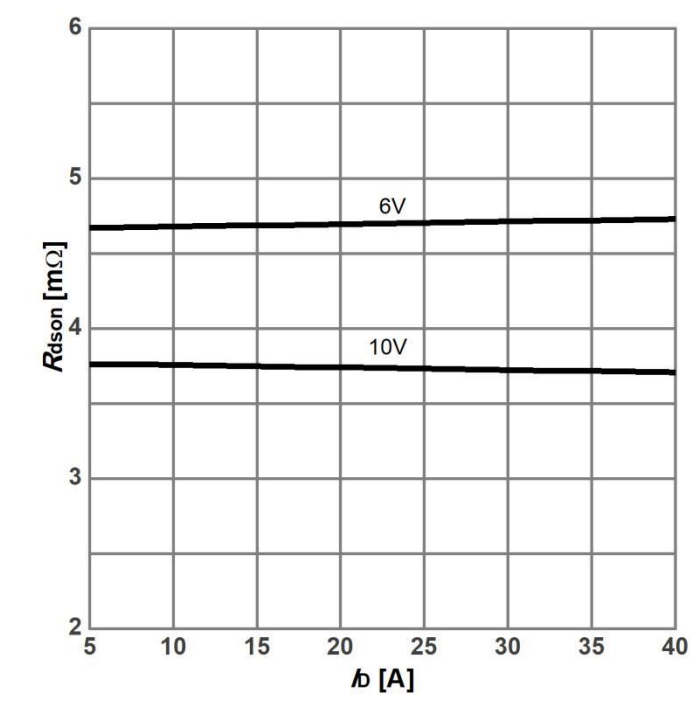
$I_D=f(V_{GS})$; $V_{DS}=5\text{V}$; parameter: T_j

Diagram 7: Gate threshold voltage vs. Junction temperature



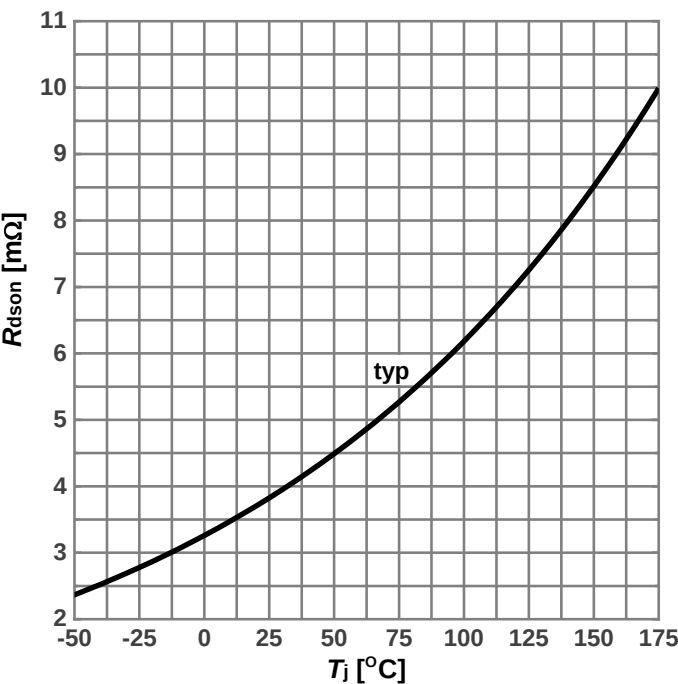
$V_{th}=f(T_j)$; $I_D=250\mu\text{A}$

Diagram 8: On-state resistance vs. Drain current



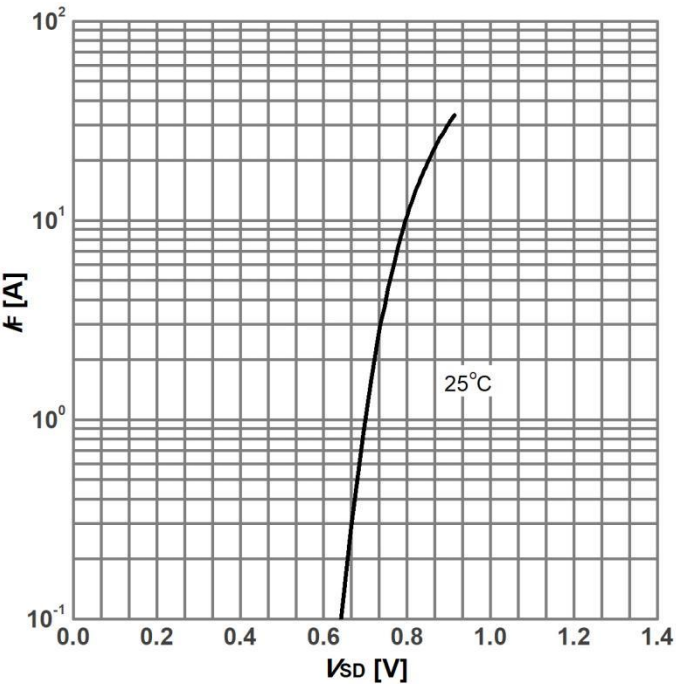
$R_{DS(on)}=f(I_D)$; $T_j=25^{\circ}\text{C}$; parameter: V_{GS}

Diagram 9: On-state resistance vs. Junction temperature



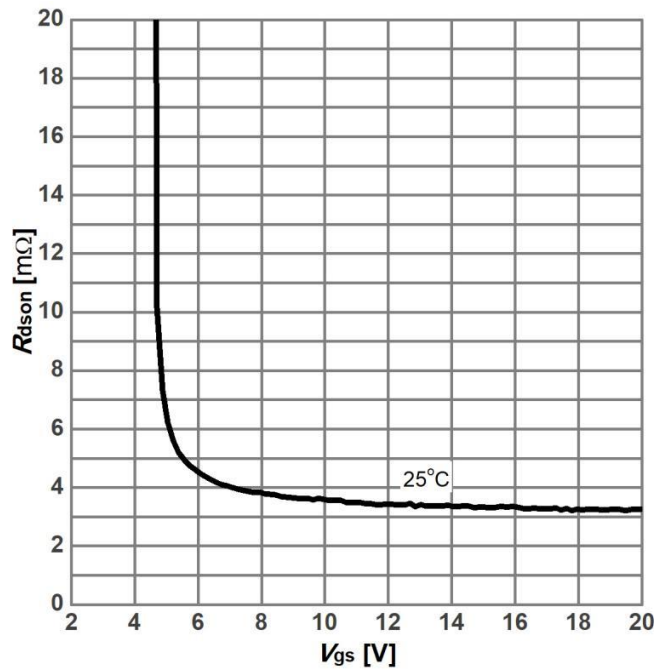
$R_{DS(on)}=f(T_j); I_D=20A; V_{GS}=10V$

Diagram 10: Forward characteristics of reverse diode



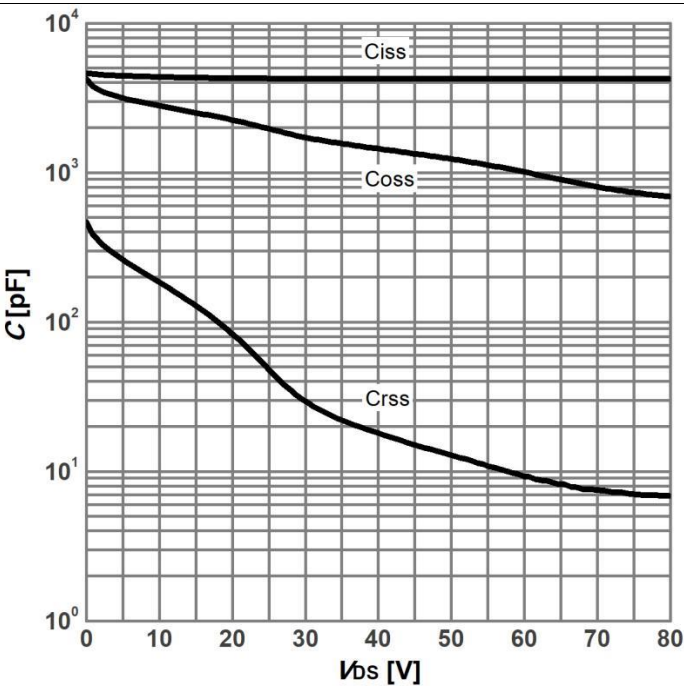
$I_F=f(V_{SD}); T_J=25^{\circ}C$

Diagram 11: On-state resistance vs. Vgs characteristics



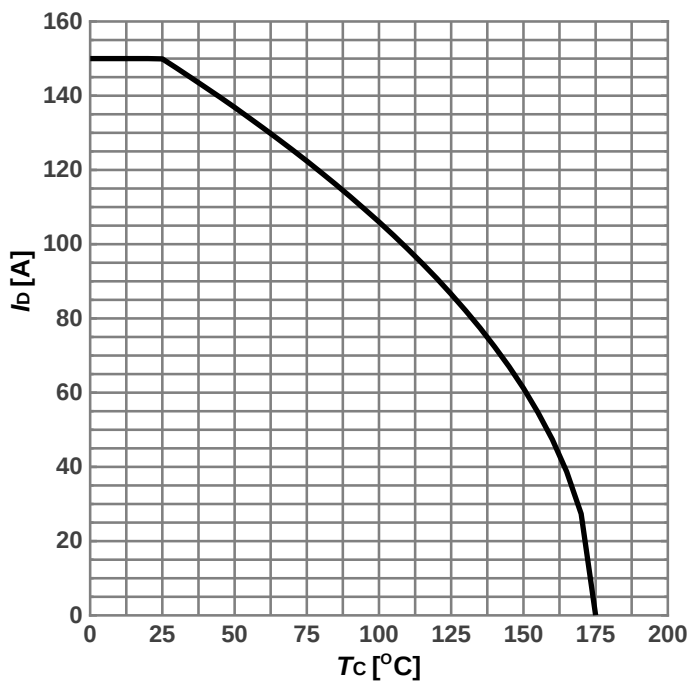
$R_{DS(on)}=f(V_{GS}); T_J=25^{\circ}C; I_D=20A$

Diagram 12: Typ. capacitances



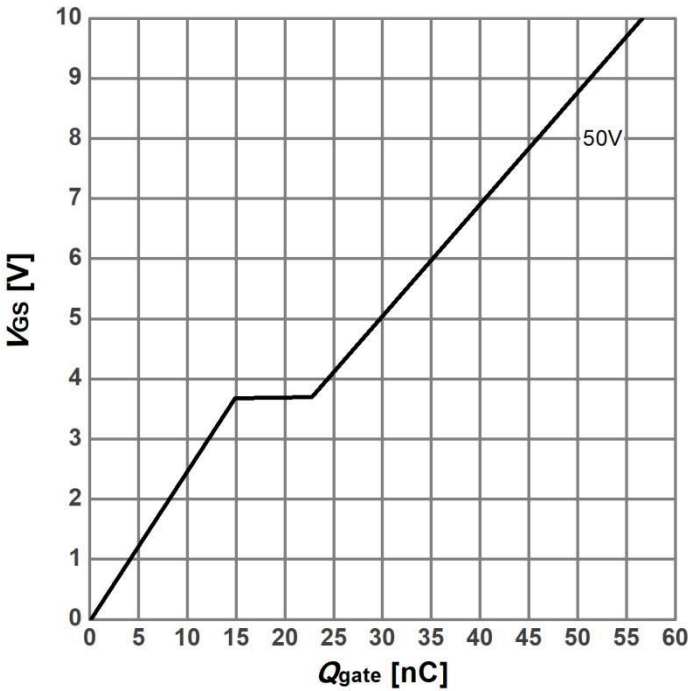
$C=f(V_{DS}); V_{GS}=0V; f=250KHz$

Diagram 13: Maximum Drain Current



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

Diagram 14: Typ. gate charge



$V_{GS} = f(Q_{gate}); I_D = 20A \text{ pulsed}; V_{DS} = 50V$

6. Test Circuits

Table 7. Diode Characteristics

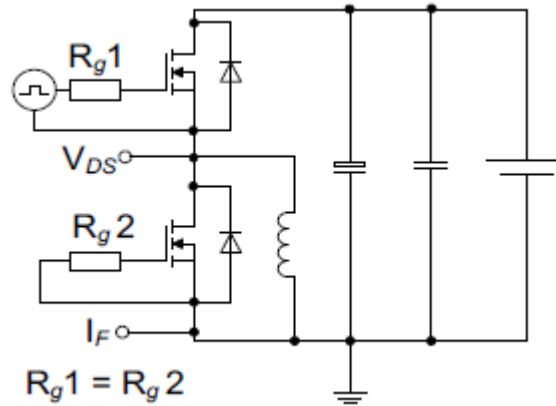
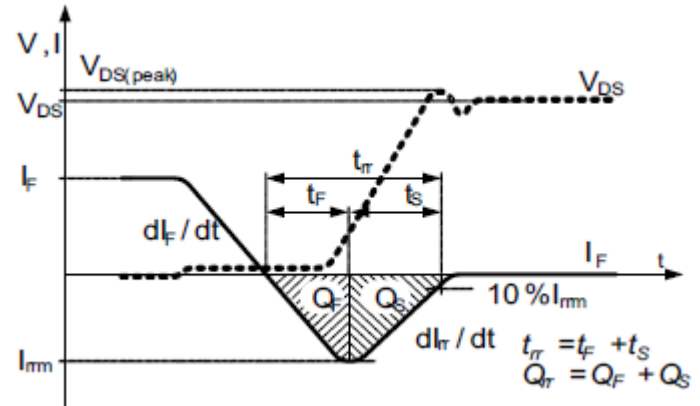
Test circuit for diode characteristics	Diode recovery waveform
	

Table 8. Switching Times

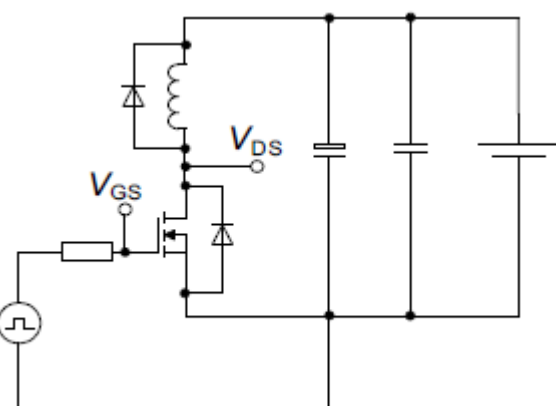
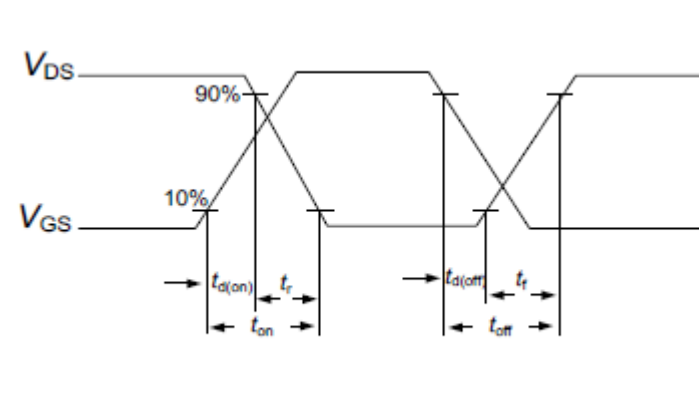
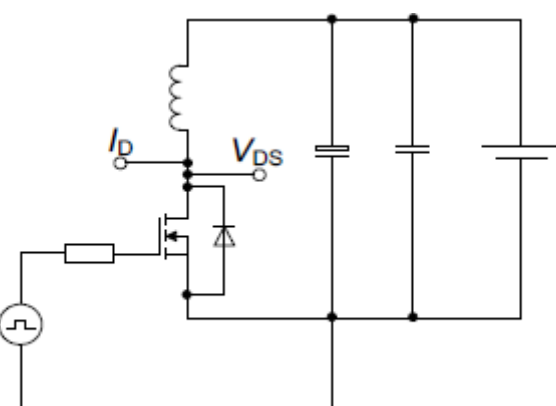
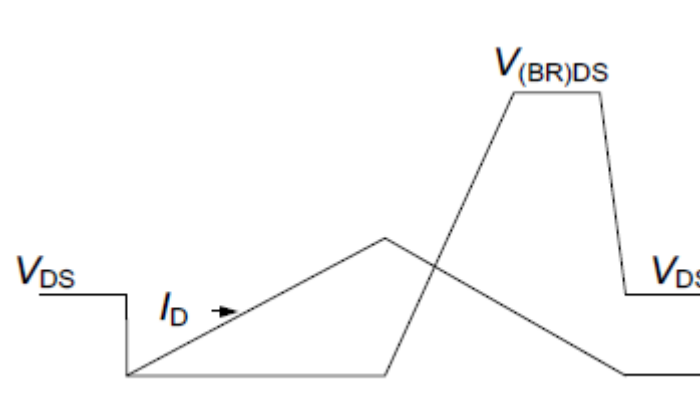
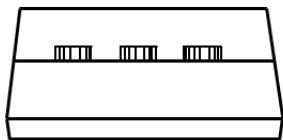
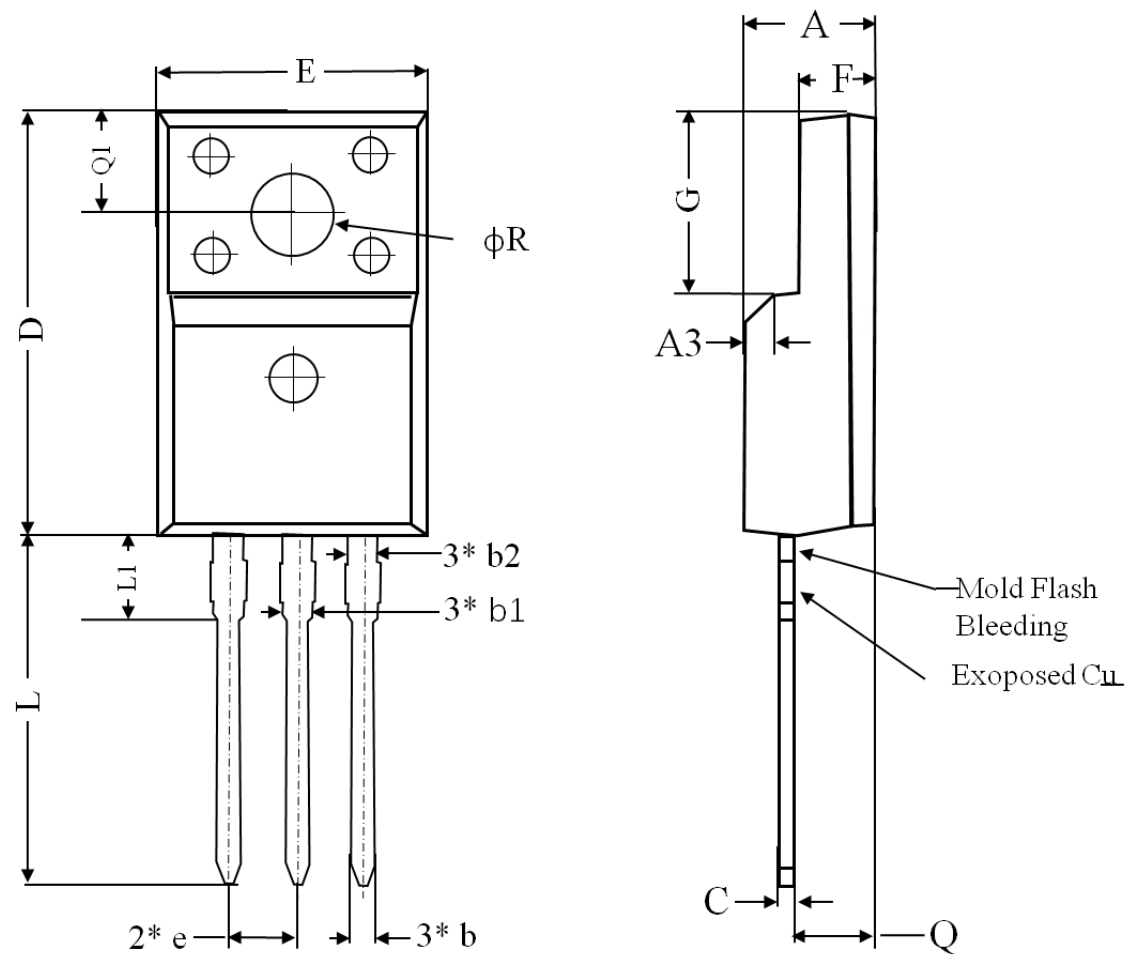
Switching times test circuit for inductive load	Switching times waveform
	

Table 9. Unclamped Inductive Load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

7. Package Outlines

Figure 1 Outline TO-220 FullPAK Dimensions in mm



- Note:
- 1. All Dimension Are In mm.
 - 2. Package Body Sizes Exclude Mold Flash And Burrs Mold Flash Should Be less Than 6 Mil.

SYMBOL	DIMENSIONS		
	Min.	Nom.	Max.
A	4.60	4.70	4.80
b	0.70	0.80	0.91
b1	1.20	1.30	1.47
b2	1.10	1.20	1.30
C	0.45	0.50	0.63
D	15.80	15.87	15.97
e	2.54		
E	10.00	10.10	10.30
F	2.44	2.54	2.64
G	6.50	6.70	6.90
L	12.90	13.10	13.30
L1	3.13	3.23	3.33
Q	2.65	2.75	2.85
Q1	3.20	3.30	3.40
Φr	3.08	3.18	3.28

8. Appendix

CoolSemi Webpage: www.coolsemi.com.