

600V N-Channel Super Junction power MOSFET

DESCRIPTION

SJ MOSFET is an advanced technology for high voltage power MOSFETs, designed according to the super junction principle by P&S. The offered devices provide all benefits of a fast switching and low on resistance, making it especially suitable for applications which require more efficient, more compact, LED Lighting, High Performance Adapter etc..

V_{DS}	600	V
$R_{DS(ON)}$	125	m Ω
I_D	30	A

Features

- Extremely low losses due to very low $R_{dson} * Q_g$
- Superior Avalanche Rugged Technology
- Fast switching capability
- 100% Avalanche Tested
- Pb-free lead plating; ROHS compliant

APPLICATIONS

- Power factor correction (PFC)
- Switched mode power supplies (SMPS)
- Uninterruptible Power Supply (UPS)
- High Performance Adapter
- LED Lighting Power



ORDERING INFORMATION

Temperature Range	Package	Orderable Device	Package Qty.
-55°C ~ +125°C	TO-220	CWS60R125AC	50 PCS/Tube
	TO-220F	CWS60R125AF	50 PCS/Tube
	TO-247	CWS60R125AZ	30 PCS/Tube



ABSOLUTE MAXIMUM RATINGS

($T_j=25^{\circ}\text{C}$, unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage ($V_{GS}=0\text{V}$)	V_{DSS}	600	V
Gate-Source Voltage ($V_{DS}=0\text{V}$, static)	V_{GS}	± 30	V
Continuous Drain Current ($T_C=25^{\circ}\text{C}$)(Note 1)	$I_{D(DC)}$	30	A
Continuous Drain Current ($T_C=100^{\circ}\text{C}$) (Note 1)	$I_{D(DC)}$	19	A
Pulsed Drain Current (Note 2)	I_{DM}	89	A
MOSFET dv/dt ruggedness, $V_{DS}\leq 480\text{V}$	dv/dt	50	V/nS
Single Pulsed Avalanche Energy (Note 3)	E_{AS}	720	mJ
Avalanche Energy, Repetitive(Note1)	E_{AR}	1.2	mJ
Avalanche Current, Single Pulsed (Note 3)	I_{AS}	12	A
Maximum Power Dissipation ($T_C=25^{\circ}\text{C}$) for TO-220, TO-220F, TO-247	P_D	TO-220: 219 TO-220F: 34 TO-247: 219	W
Operating, Storage Temperature Range	T_J, T_{STG}	-55~150	$^{\circ}\text{C}$

THERMAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Units
Thermal Resistance, Junction-to-Case	R_{thJC}	-	-	TO-220: 0.57 TO-220F: 3.65 TO-247: 0.57	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	-	-	TO-220: 62 TO-220F: 80 TO-247: 62	$^{\circ}\text{C/W}$

ELECTRICAL CHARACTERISTICS

($T_j = 25^{\circ}\text{C}$, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min.	TYP.	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0\text{V}, I_D=250\mu\text{A}$	600	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=600\text{V}, V_{GS}=0\text{V}$	-	-	1	μA
Gate-Source Leakage Current	I_{GSS}	$V_{GS}=\pm 30\text{V}, V_{DS}=0\text{V}$	-	-	± 100	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	2.5	3.0	3.5	V
Drain-Source On-state Resistance	$R_{DS(on)}$	$V_{GS}=10\text{V}, I_D=15\text{A}$	-	0.10	0.125	Ω
Gate Resistance	R_g	F=1MHZ, open drain	-	5.6	-	Ω



Dynamic Characteristics

($T_j = 25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Input capacitance	C_{iss}	$V_{DS}=100\text{V}, V_{GS}=0\text{V},$ $f=1\text{MHz}$	-	2039	-	pF
Output capacitance	C_{oss}		-	127	-	
Reverse transfer capacitance	C_{rss}		-	2.5	-	
Turn-on delay Time	$t_{d(on)}$	$V_{DD}=400\text{V}, I_D=15\text{A}$ $R_G=3.3\Omega, V_{GS}=10\text{V}$	-	49	-	ns
Rise time	t_r		-	77		
Turn-off delay time	$t_{d(off)}$		-	182		
Fall time	t_f		-	61		

Gate charge characteristics

($T_j = 25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Gate to Source Charge	Q_{gs}	$V_{DD}=480\text{V}, I_D=15\text{A}$ $V_{GS}=0$ to 10V	-	12.6	-	nC
Gate to Drain Charge	Q_{gd}		-	16	-	
Gate Charge Total	Q_g		-	45.5	-	
Gate Plateau Voltage	$V_{plateau}$		-	6.4	-	V

Reverse diode characteristics

($T_j = 25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Body Diode Forward Voltage	V_{SD}	$V_{GS}=0\text{V}, I_{SD}=15\text{A}$	-	0.9	-	V
Reverse Recovery Time	t_{rr}	$V_R=400\text{V}, I_F=15\text{A}$ $di_F/dt=100\text{A}/\mu\text{s}$	-	409	-	nS
Reverse Recovery Charge	Q_{rr}		-	8.5	-	μC
Peak Reverse Recovery Current	I_{rrm}		-	30	-	A

Notes:

- Limited by maximum junction temperature;
- Pulse width limited by maximum junction temperature;
- $I_{AS} = 12\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$, Starting $T_j = 25^\circ\text{C}$.

Electrical Characteristics Diagrams

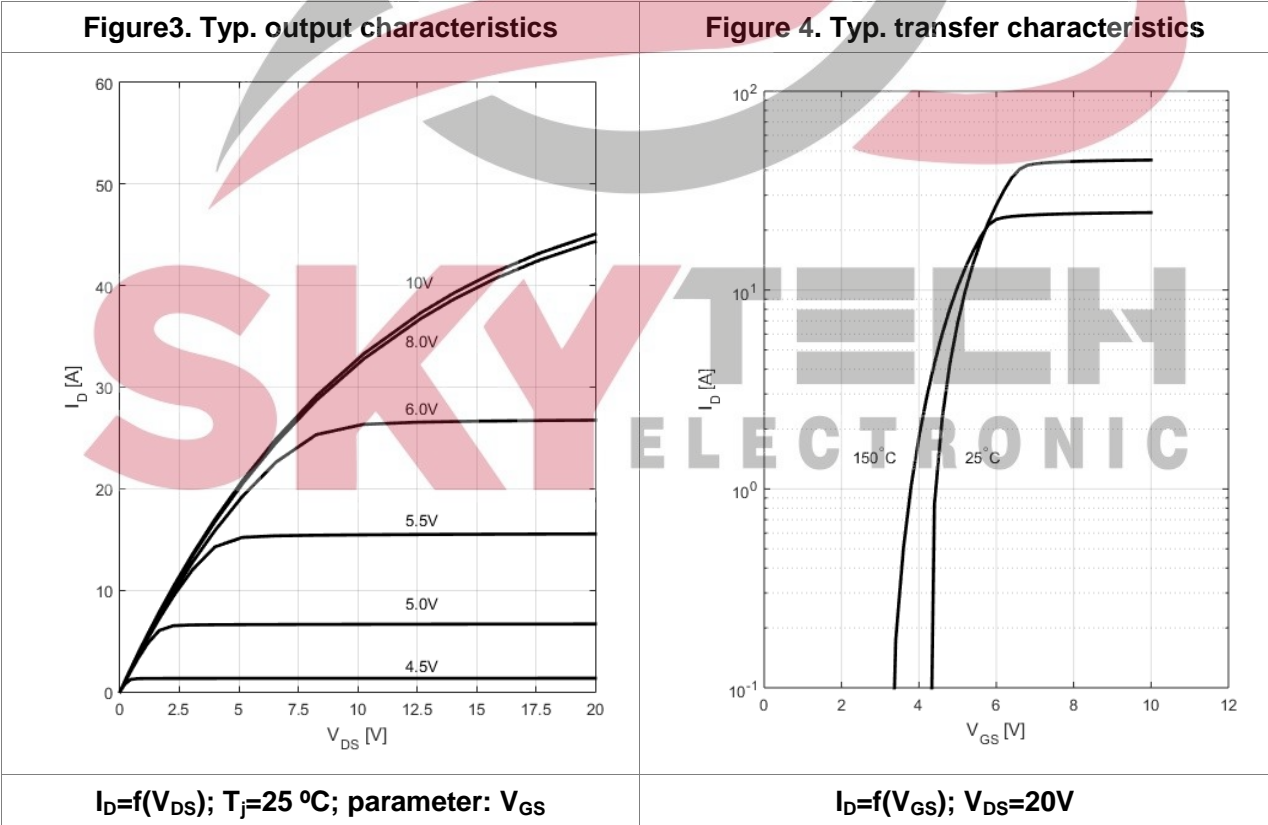
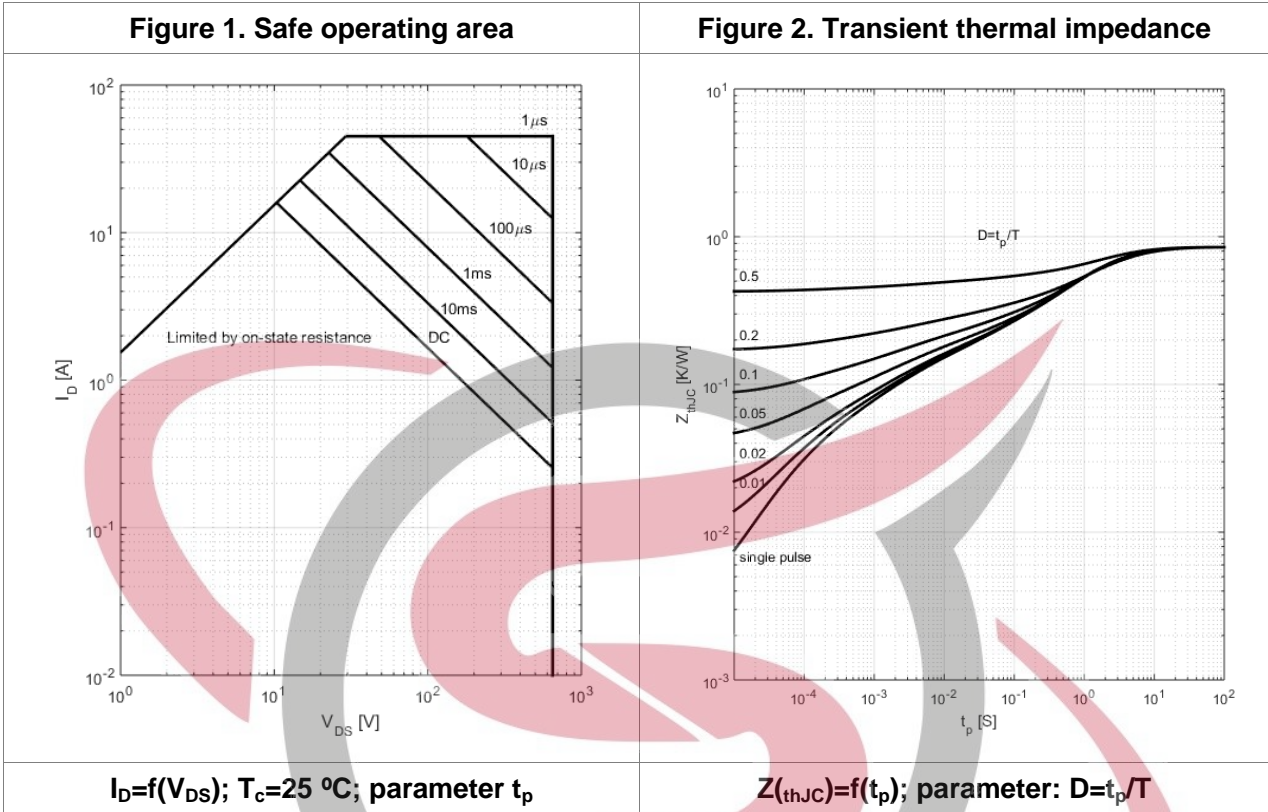
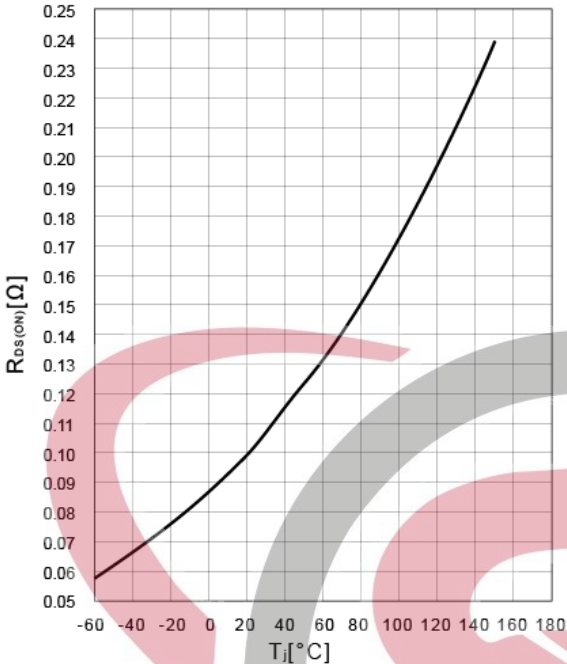
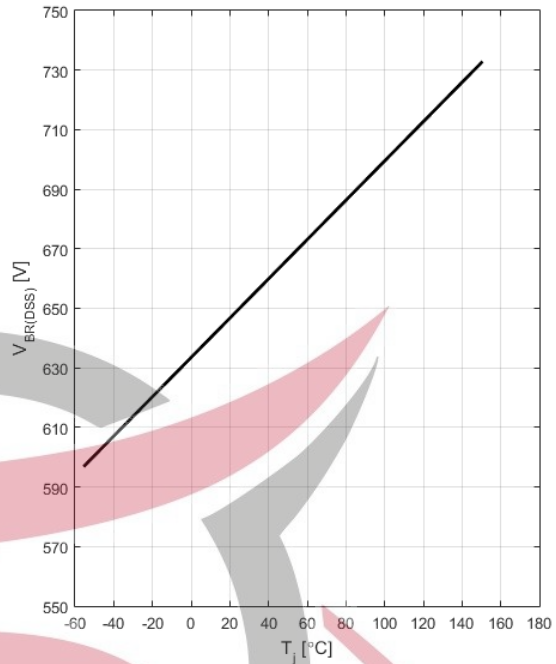


Figure 5. Drain-source on-state resistance



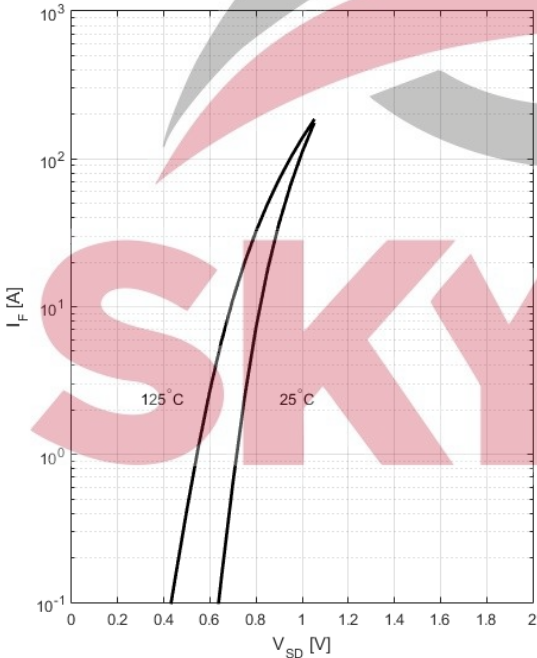
$R_{DS(ON)}=f(T_j); I_D=30A; V_{GS}=10V$

Figure6. Drain-source breakdown voltage



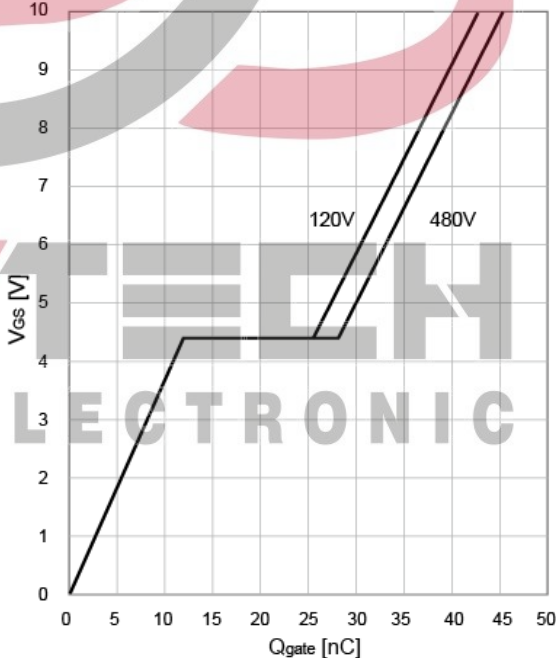
$V_{BR(DSS)}=f(T_j); I_D=10mA$

Figure7. Forward characteristics of reverse diode



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

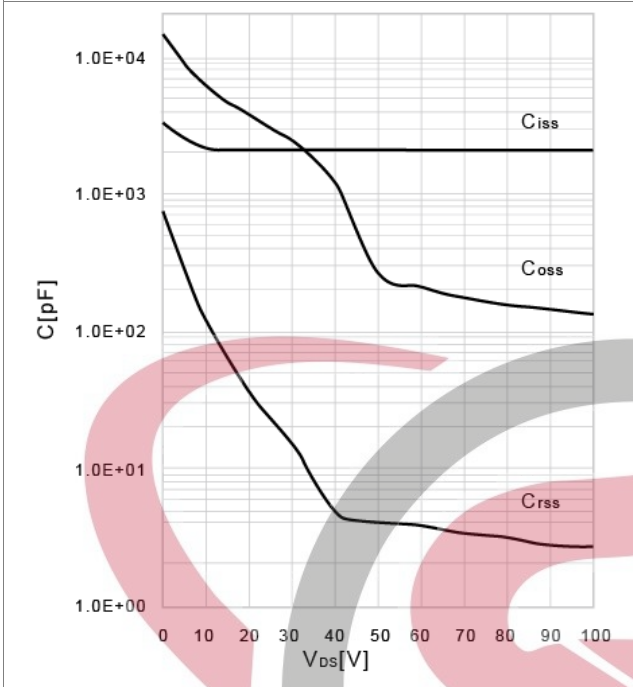
Figure 8. Typ. gate charge



$V_{GS}=f(Q_{gate}), I_D=30A \text{ pulsed}$

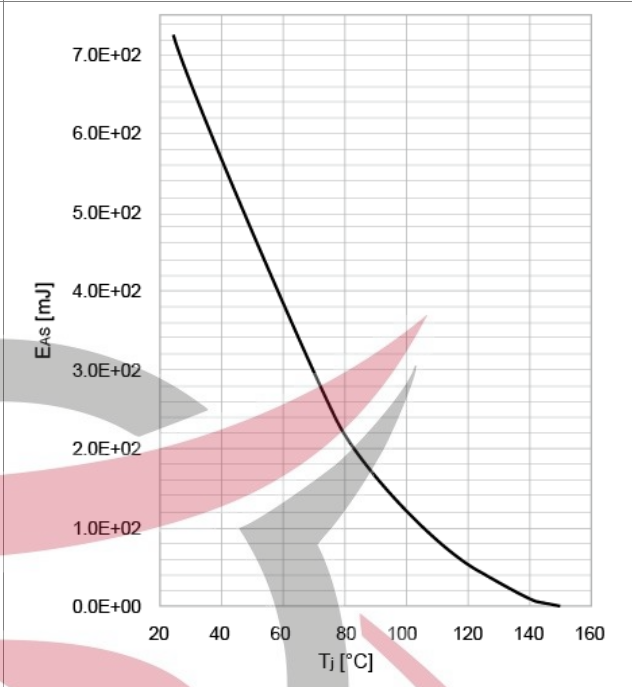


Figure 9: Typ. capacitances



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

Figure 10: Avalanche energy

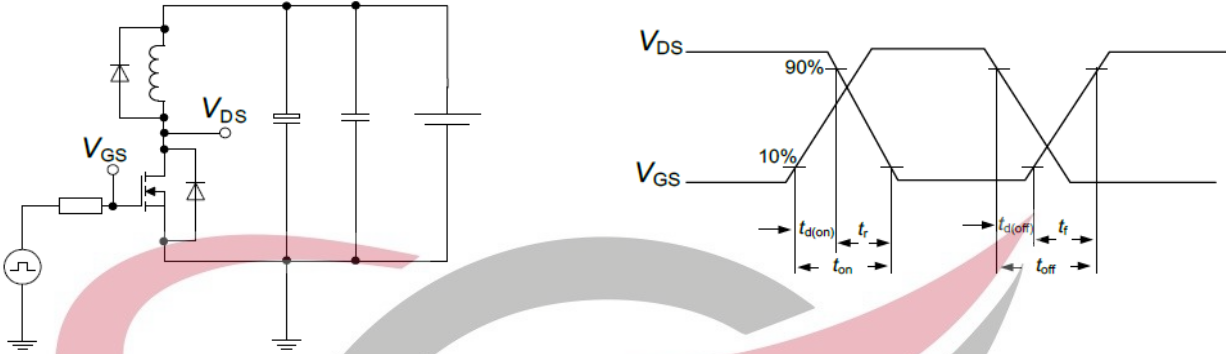


E_{AS}=f(T_j); I_D=13A; V_{DD}=50V

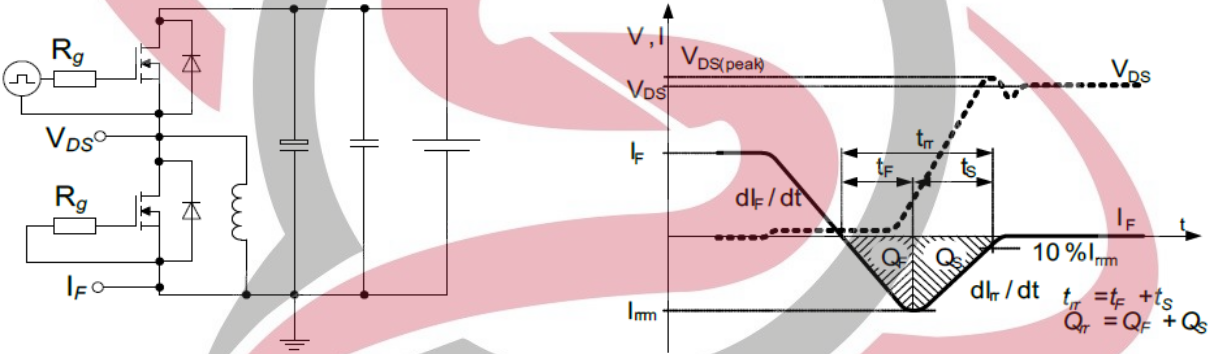


Test Circuits

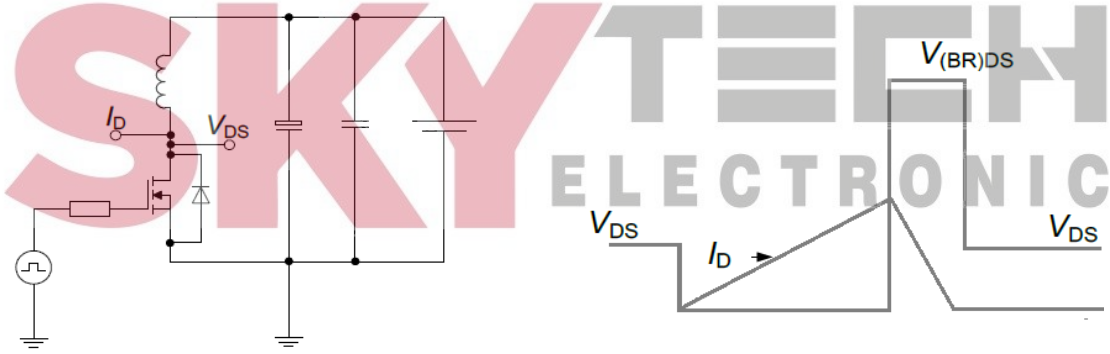
Switch time test circuit



Reverse diode characteristics test circuit and waveform

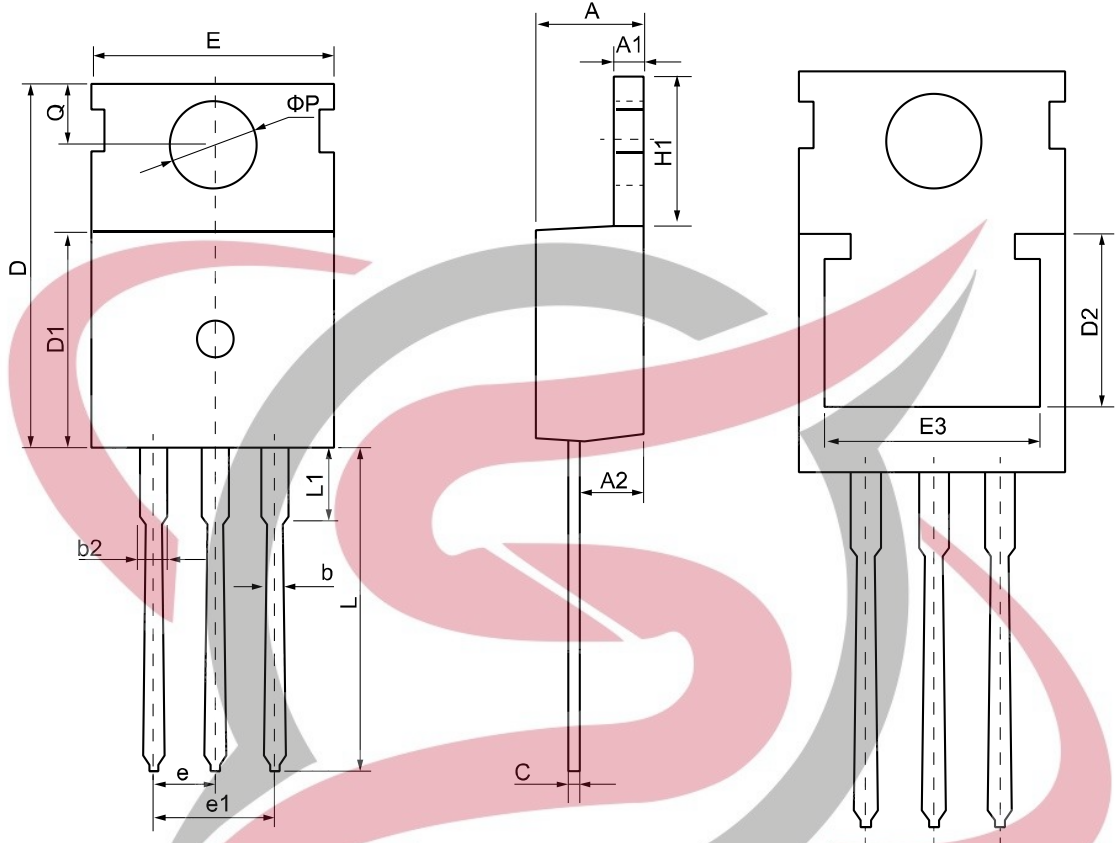


Unclaimed inductive switching test circuit & waveform



PHYSICAL DIMENSIONS

TO-220



Symbol	Dimension (mm)			Symbol	Dimension (mm)		
	Min	Nom	Max		Min	Nom	Max
A	4.37	4.57	4.77	E	9.80	10.00	10.20
A1	1.25	1.30	1.45	E3	7.00	-	-
A2	2.20	2.40	2.60	e	2.54(BSC)		
b	0.70	0.80	0.95	e1	5.08(BSC)		
b2	1.17	1.27	1.47	H1	6.30	6.50	6.80
c	0.40	0.50	0.65	L	12.75	13.50	13.80
D	15.30	15.60	15.90	L1	-	3.10	3.40
D1	8.90	9.10	9.30	ΦP	3.40	3.60	3.80
D2	5.50	-	-	Q	2.60	2.80	3.00

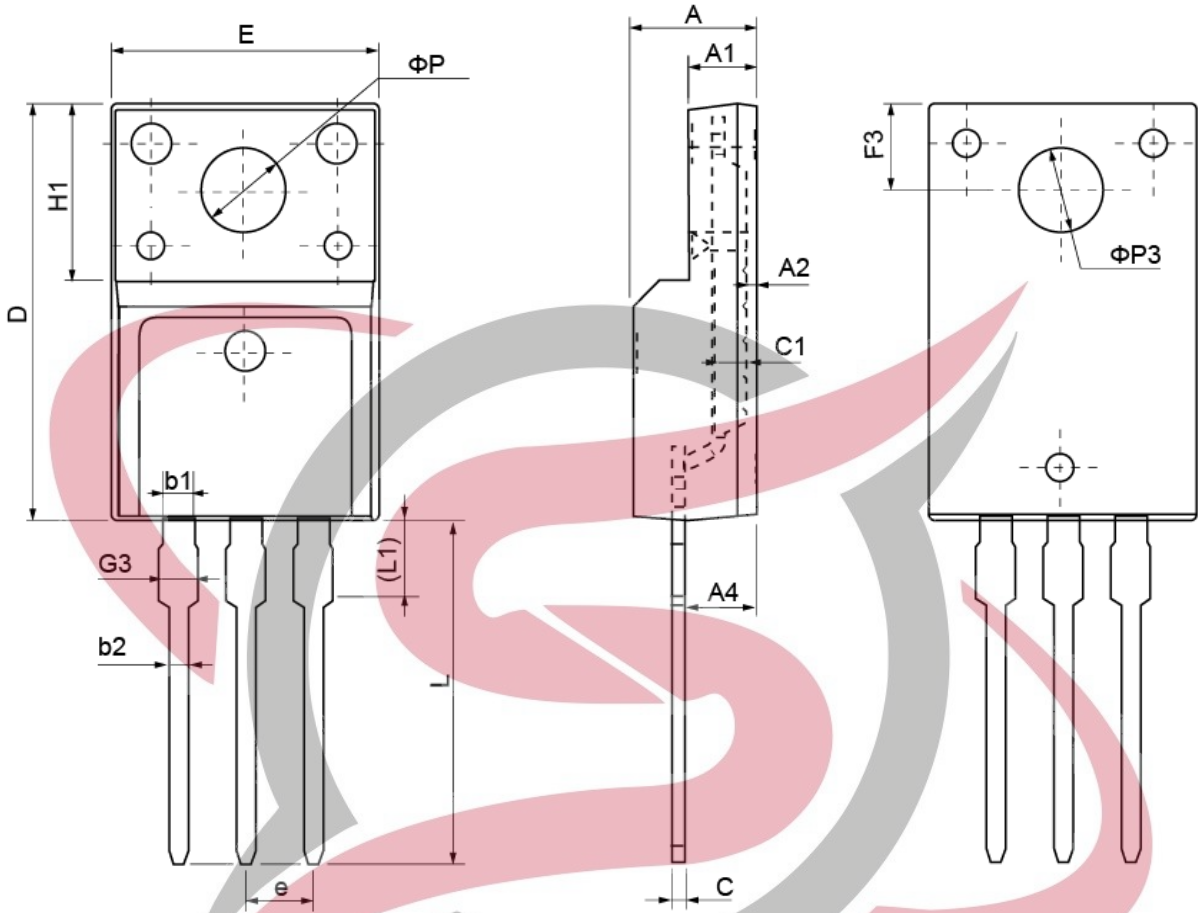


Mar. 2018

Rev 1.10

CWS60R125A

TO-220F



Symbol	Dimension (mm)			Symbol	Dimension (mm)		
	Min	Nom	Max		Min	Nom	Max
E	9.96	10.16	10.36	e	2.54(BSC)		
A	4.50	4.70	4.90	L	12.68	12.98	13.28
A1	2.34	2.54	2.74	L1	2.93	3.03	3.13
A2	0.30	0.45	0.60	ΦP	3.03	3.18	3.38
A4	2.56	2.76	2.96	$\Phi P3$	3.15	3.45	3.65
c	0.40	0.50	0.65	F3	3.15	3.30	3.45
c1	1.20	1.30	1.35	G3	1.25	1.35	1.55
D	15.57	15.87	16.17	b1	1.18	1.28	1.43
H1	6.70(REF)			b2	0.70	0.80	0.95



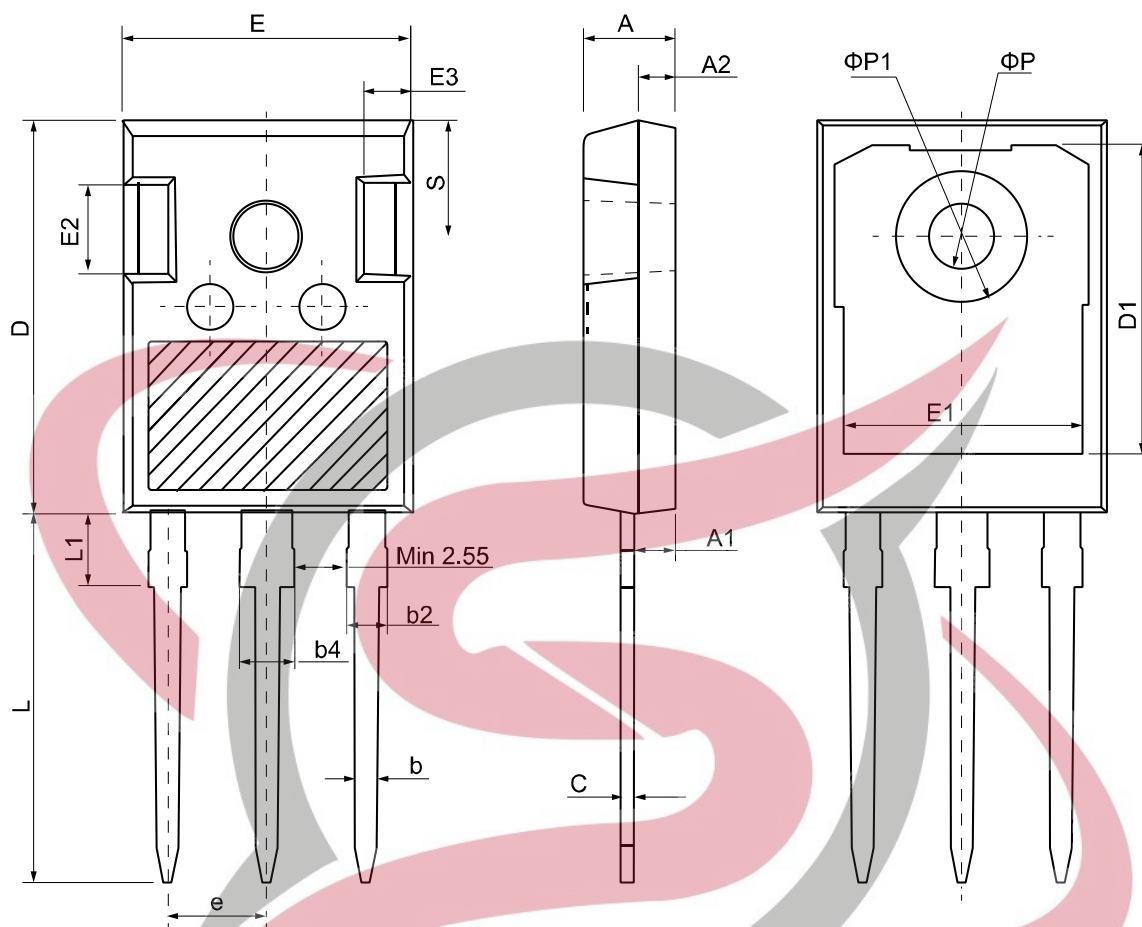
Mar. 2018

Rev 1.10

www.icbase.com

CWS60R125A

TO-247



Symbol	Dimension (mm)			Symbol	Dimension (mm)		
	Min	Nom	Max		Min	Nom	Max
A	4.80	5.00	5.20	E1	13.00	13.30	13.60
A1	2.21	2.41	2.59	E2	4.80	5.00	5.20
A2	1.85	2.00	2.15	E3	2.30	2.50	2.70
b	1.11	1.21	1.36	e	5.44(BSC)		
b2	1.91	2.01	2.21	L	19.82	19.92	20.22
b4	2.91	3.01	3.21	L1	-	-	4.30
c	0.51	0.61	0.75	ΦP	3.40	3.60	3.80
D	20.80	21.00	21.30	ΦP1	-	-	7.30
D1	16.25	16.55	16.85	S	6.15(BSC)		
E	15.50	15.80	16.10	-	-	-	-

< Copyright >

All the Patent, Copyright and IP contained in this document belong to P&S, shall not be reproduced, copied, or used in other ways without permission.



Mar. 2018

Rev 1.10

www.icbase.com