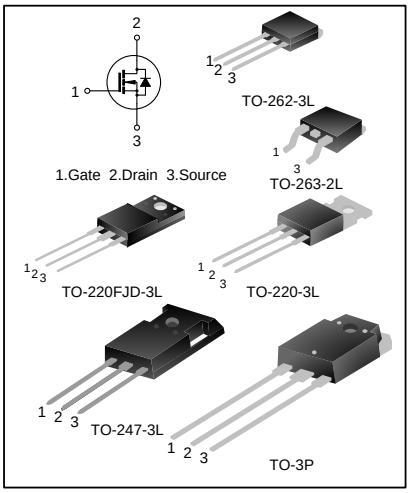
20A, 600V SUPER JUNCTION MOS POWER TRANSISTOR

GENERAL DESCRIPTION

SVSP20N60FJD(K)(T)(PN)(S)(P7)D2 is an N-channel enhancement mode high voltage power MOSFETs produced using Silan's super junction MOS technology. It achieves low conduction loss and switching losses. It leads the design engineers to their power converters with high efficiency, high power density, and superior thermal behavior. Furthermore, it's universal applicable, for example. it is suitable for hard and soft switching topologies.



FEATURES

- 20A, 600V, $R_{DS(on)(typ.)}$=0.16Ω@V_{GS}=10V
- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme dv/dt rated
- High peak current capability

ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing Type
SVSP20N60FJDD2	TO-220FJD-3L	P20N60FJD	Halogen free	Tube
SVSP20N60KD2	TO-262-3L	P20N60KD2	Halogen free	Tube
SVSP20N60TD2	TO-220-3L	P20N60TD2	Halogen free	Tube
SVSP20N60PND2	TO-3P	P20N60PN	Halogen free	Tube
SVSP20N60SD2	TO-263-2L	P20N60SD2	Halogen free	Tube
SVSP20N60SD2TR	TO-263-2L	P20N60SD2	Halogen free	Tape&Reel
SVSP20N60P7D2	TO-247-3L	P20N60	Halogen free	Tube

ABSOLUTE MAXIMUM RATINGS (T_J=25°C, UNLESS OTHERWISE NOTED)

Characteristics		Symbol	Ratings			Unit
			SVSP20N60 FJDD2	SVSP20N60 KD2/TD2/SD2	SVSP20N60 PN/P7D2	
Drain-Source Voltage		V_{DS}	600			V
Gate-Source Voltage		V_{GS}	±30			V
Drain Current	T_C=25°C	I_D	20			A
	T_C=100°C		12			
Drain Current Pulsed(Pulse time 5μs)		I_{DM}	80			A
Power Dissipation(T_C=25°C)		P_D	45	150	200	W
-Derate above 25°C			0.36	1.2	1.6	W/°C
Single Pulsed Avalanche Energy (Note 1)		E_{AS}	967			mJ
Reverse diode dv/dt (Note 2)		dv/dt	15			V/ns
MOSFET dv/dt ruggedness (Note 3)		dv/dt	50			V/ns
Operation Junction Temperature Range		T_J	-55～+150			°C
Storage Temperature Range		T_{stg}	-55～+150			°C

THERMAL CHARACTERISTICS

Characteristics	Symbol	Ratings			Unit
		SVSP20N60 FJDD2	SVSP20N60 KD2/TD2/SD2	SVS20PN60 PN/P7D2	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	2.78	0.83	0.63	°C/W
Thermal Resistance, junction-to-Ambient	$R_{\theta JA}$	62.5	62.5	50.0	°C/W

ELECTRICAL CHARACTERISTICS (T_J=25°C, UNLESS OTHERWISE NOTED)

Characteristics	Symbol	Test conditions		Min.	Typ.	Max.	Unit
Drain -Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=250μA		600	--	--	V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=600V, V_{GS}=0V		--	--	1.0	μA
Gate-Source Leakage Current	I_{GSS}	V_{GS}=±30V, V_{DS}=0V		--	--	±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS}=V_{DS}, I_D=250μA		2.0	--	4.0	V
Static Drain-Source On State Resistance	$R_{DS(on)}$	V_{GS}=10V, I_D=10A	T_J=25°C	--	0.16	0.19	Ω
			T_J=125°C	--	0.30	--	
Gate resistance	R_g	f=1.0MHz		--	2.6	--	Ω
Input Capacitance	C_{iss}	V_{DS}=100V, V_{GS}=0V, f=1.0MHz		--	1174	--	pF
Output Capacitance	C_{oss}			--	67	--	
Reverse Transfer Capacitance	C_{rss}			--	4.0	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=300V, V_{GS}=10V, R_G=25Ω, I_D=20A (Note 4, 5)		--	20	--	ns
Turn-on Rise Time	t_r			--	60	--	
Turn-off Delay Time	$t_{d(off)}$			--	105	--	
Turn-off Fall Time	t_f			--	42	--	
Total Gate Charge	Q_g	V_{DD}=480V, V_{GS}=10V, I_D=20A (Note 4, 5)		--	39	--	nC
Gate-Source Charge	Q_{gs}			--	9.6	--	
Gate-Drain Charge	Q_{gd}			--	20	--	

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Continuous Source Current	I_S	Integral Reverse P-N Junction Diode in the MOSFET	--	--	20	A
Pulsed Source Current	I_{SM}		--	--	80	
Diode Forward Voltage	V_{SD}	I_S=20A, V_{GS}=0V	--	--	1.2	V
Reverse Recovery Time	T_{rr}	V_{DD}=50V, I_F=20A, dI_F/dt=100A/μs (Note 4)	--	426	--	ns
Reverse Recovery Charge	Q_{rr}		--	6.2	--	μC

Notes:

1. L=79mH, I_{AS}=4.6A, V_{DD}=100V, R_G=25Ω, starting T_J=25°C;
2. V_{DS}=0~400V, I_{SD}<=20A, T_J=25°C;
3. V_{DS}=0~480V;
4. Pulse Test: Pulse width ≤300μs, Duty cycle≤2%;
5. Essentially independent of operating temperature.

TYPICAL CHARACTERISTICS

Figure 1. On-Region Characteristics

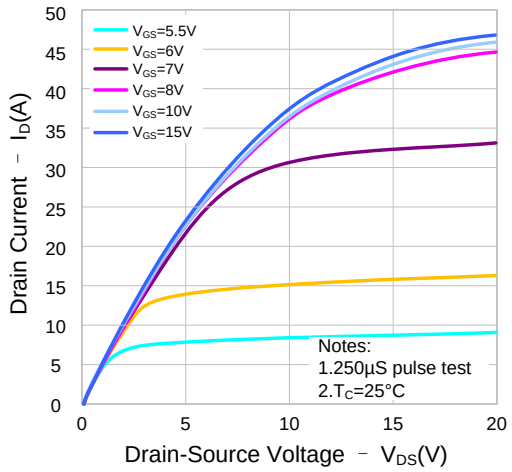


Figure 2. On-Region Characteristics

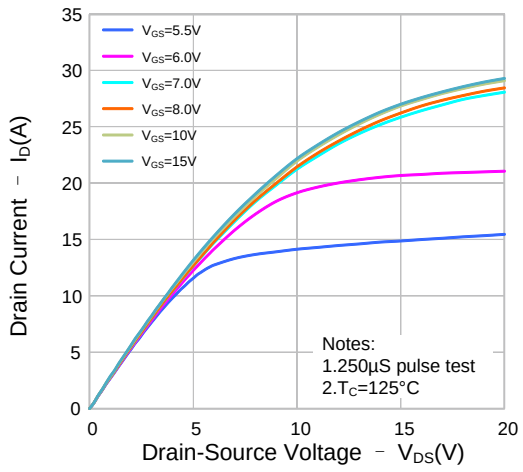


Figure 3. Transfer Characteristics

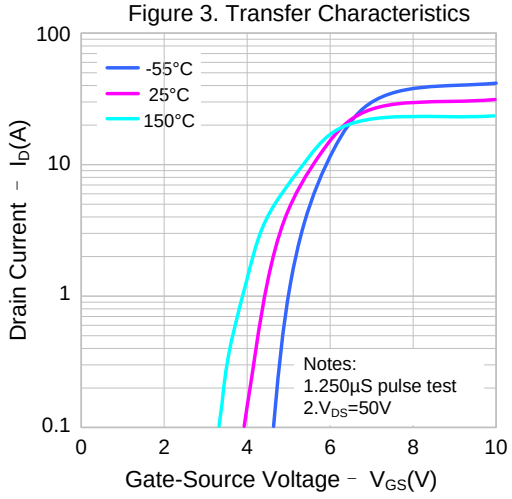


Figure 4. On-Resitance Variation vs. Drain Current

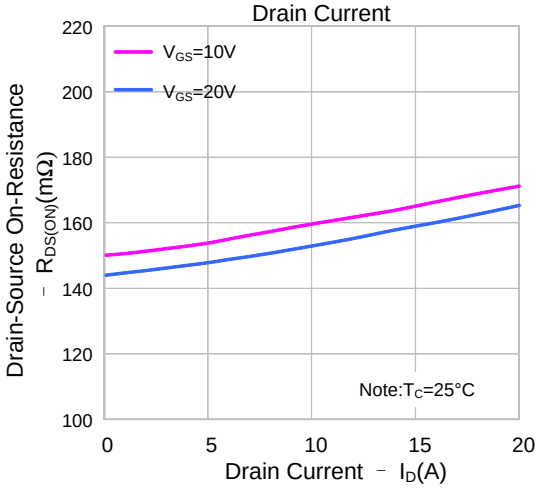


Figure 5. On-resistance vs. Gate-Source Voltage

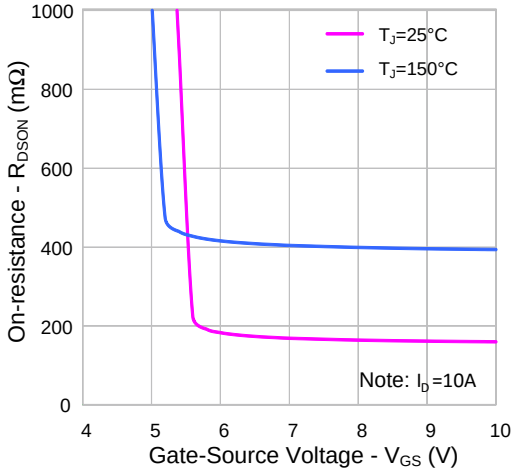
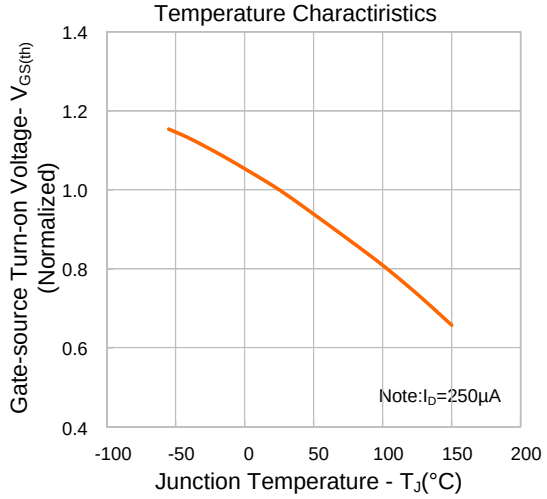


Figure 6. Gate-source Turn-on Voltage vs. Temperature Characteristics



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 7. Body Diode Forward Voltage Variation vs. Source Current and Temperature

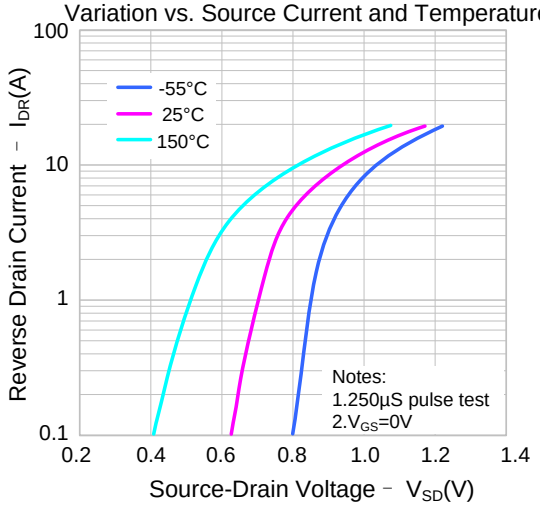


Figure 8. Capacitance Characteristics

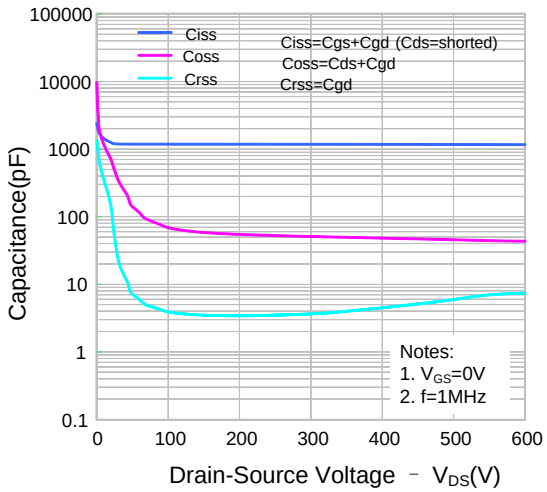


Figure 9. Gate Charge Characteristics

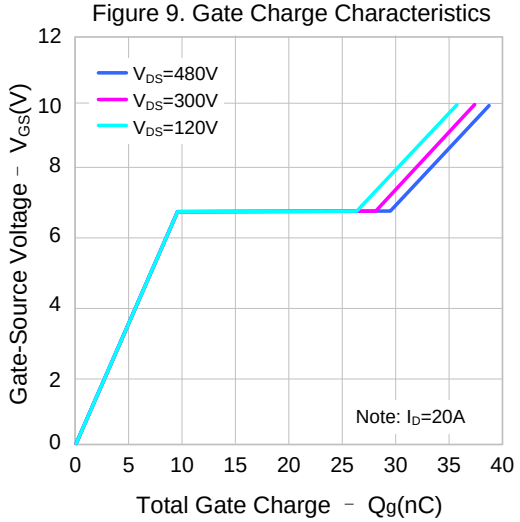


Figure 10. Breakdown Voltage Variation vs. Temperature

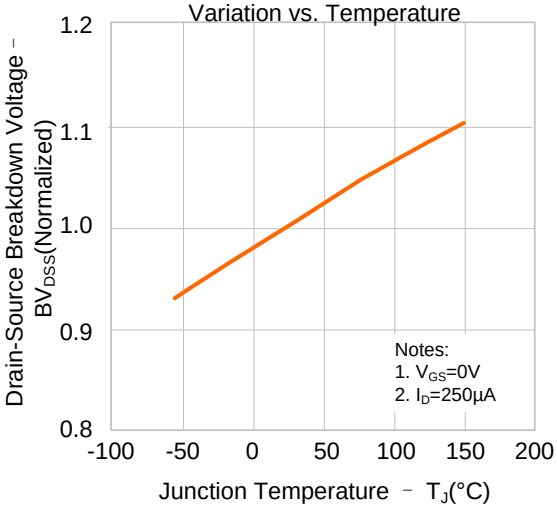


Figure 11. On-resistance Variation vs. Temperature

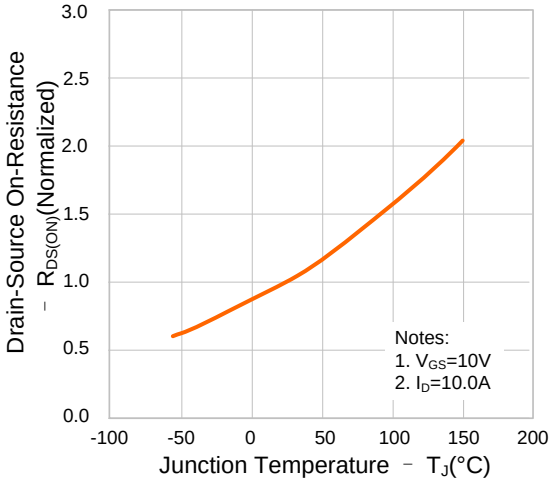
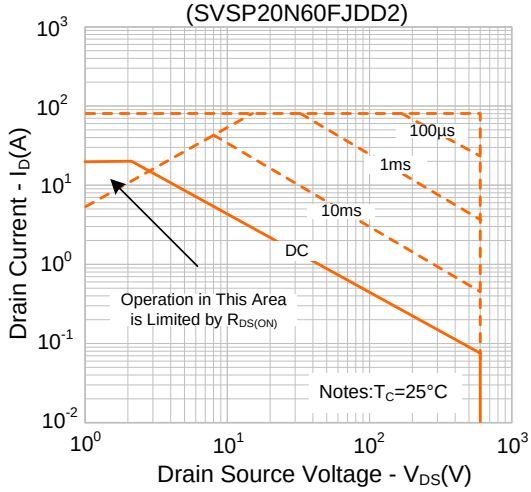


Figure 12-1. Max. Safe Operating Area (SVSP20N60FJDD2)



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 12-2. Max. Safe Operating Area (SVSP20N60KD2/TD2/SD2)

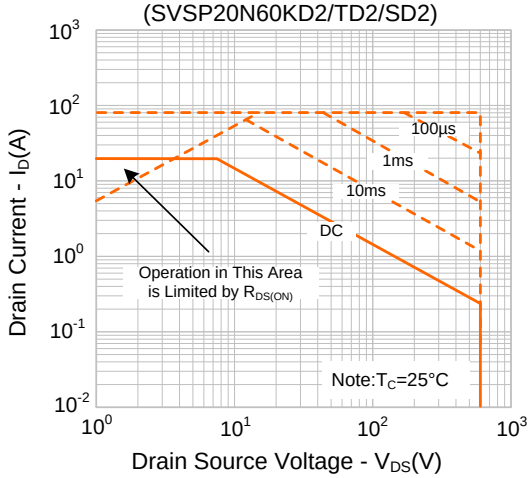


Figure 12-3. Max. Safe Operating Area (SVSP20N60PN/P7D2)

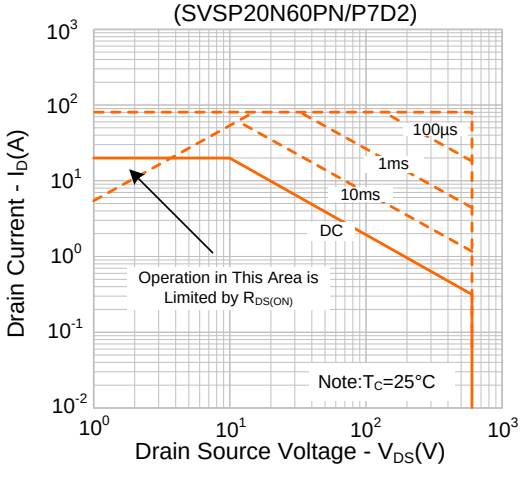
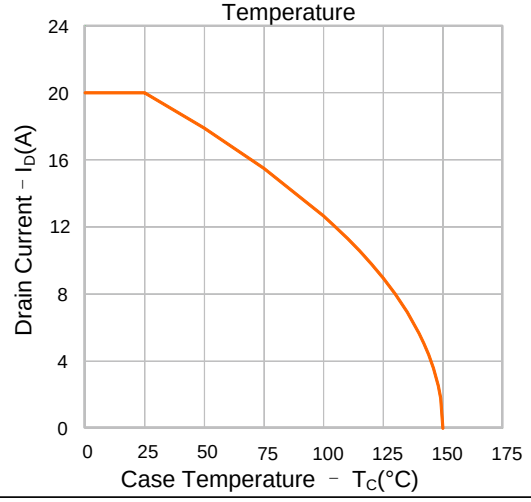
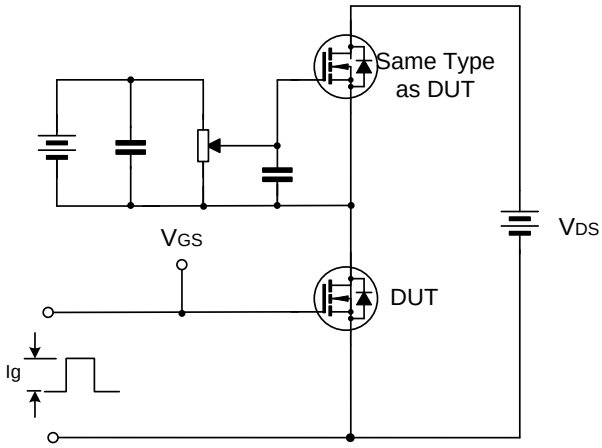


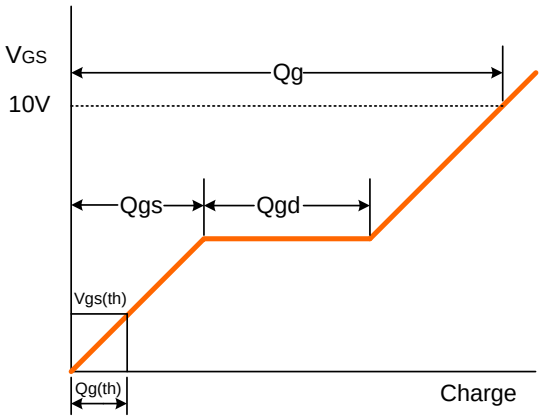
Figure13. Maximum Drain Current vs. Case Temperature



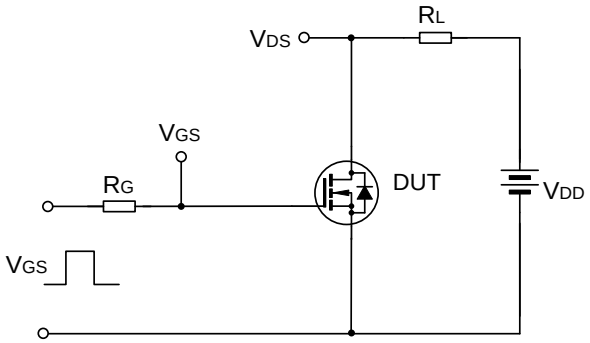
TYPICAL TEST CIRCUIT

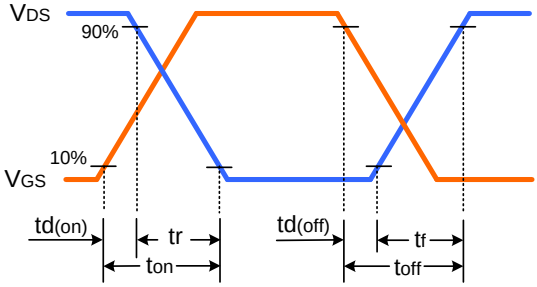
Gate Charge Test Circuit & Waveform



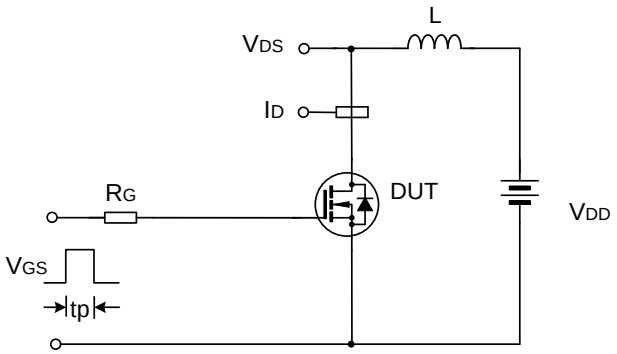


Resistive Switching Test Circuit & Waveform

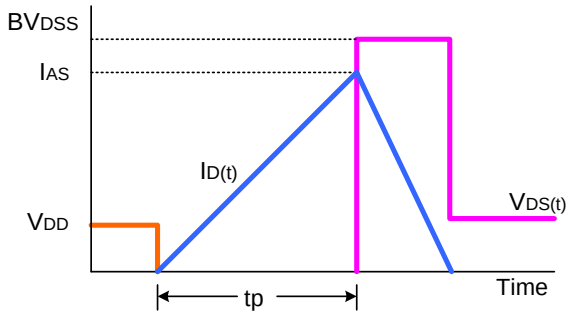




Unclamped Inductive Switching Test Circuit & Waveform

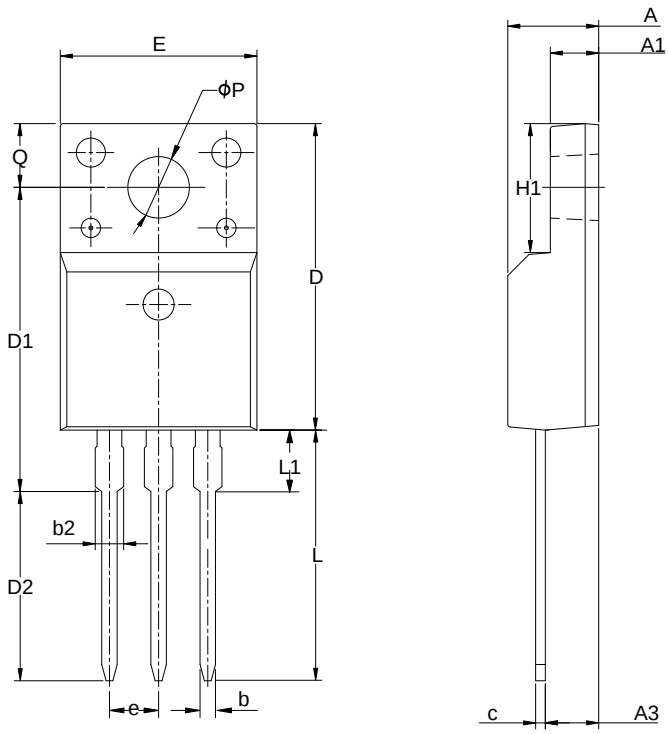


$$E_{AS} = \frac{1}{2} LI_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



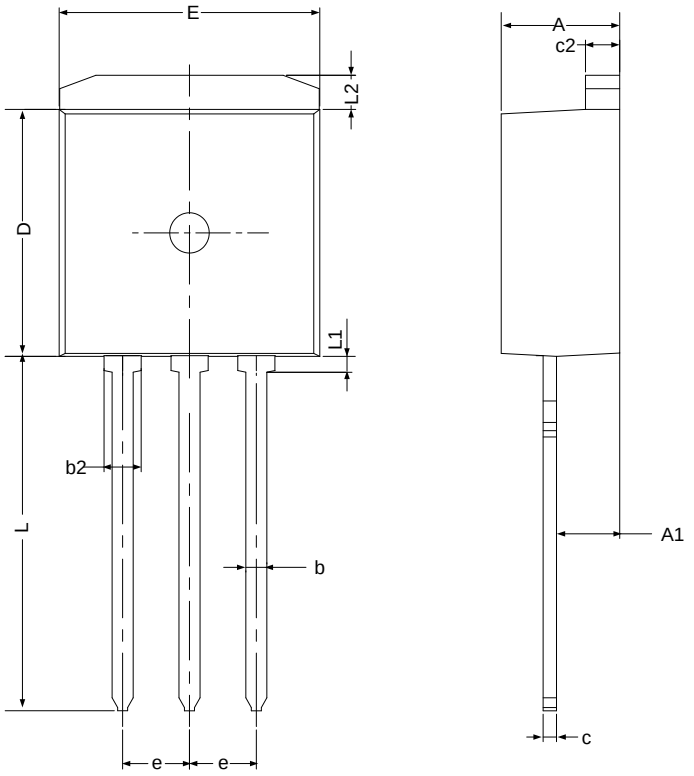
PACKAGE OUTLINE

TO-220FJD-3L **UNIT: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.55	0.70	0.85
b2	—	—	1.29
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	13.97	14.47	14.97
D2	10.58	11.08	11.58
E	9.73	10.16	10.36
e	2.54BSC		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	—	—	2.00
ϕP	3.00	3.18	3.40
Q	3.05	3.30	3.55

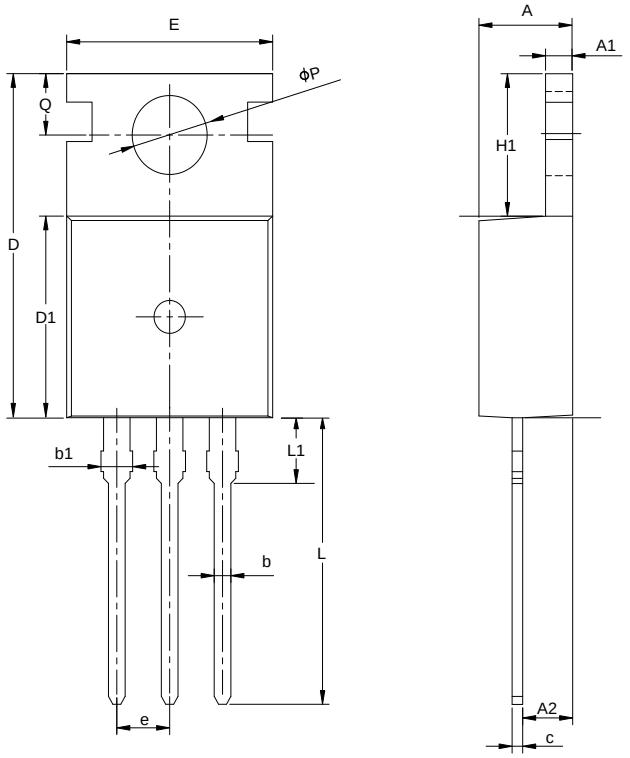
TO-262-3L **UNIT: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	2.20	—	2.92
b	0.71	0.80	0.90
b2	1.20	—	1.50
c	0.34	—	0.65
c2	1.22	1.30	1.35
D	8.38	—	9.30
E	9.80	10.16	10.54
e	2.54 BSC		
L	12.80	—	14.10
L1	—	—	0.75
L2	1.12	—	1.42

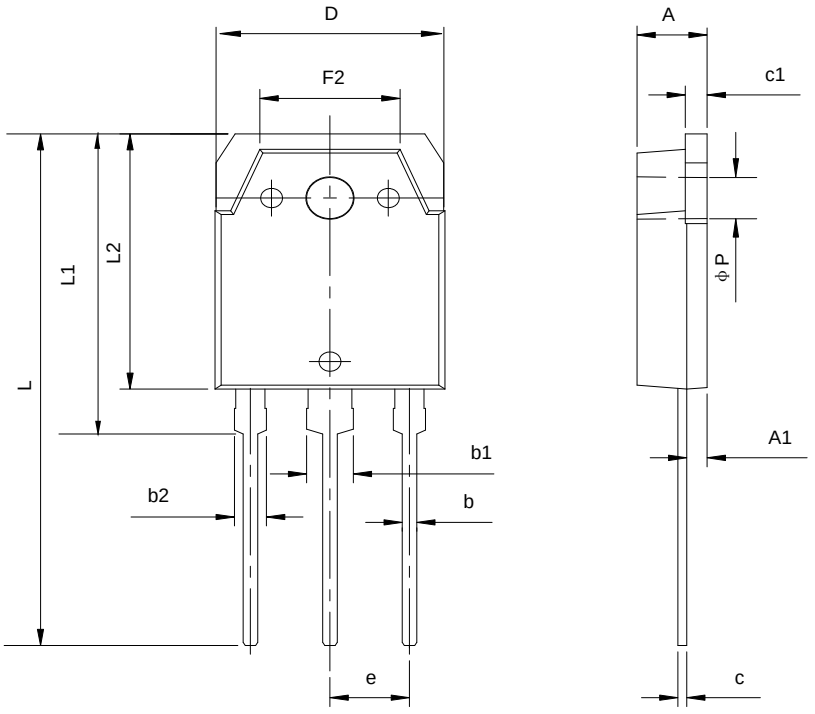
PACKAGE OUTLINE(CONTINUED)

TO-220-3L **UNIT: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	1.00	1.30	1.50
A2	1.80	2.40	2.80
b	0.60	0.80	1.00
b1	1.00	—	1.60
c	0.30	—	0.70
D	15.10	15.70	16.10
D1	8.10	9.20	10.00
E	9.60	9.90	10.40
e	2.54BSC		
H1	6.10	6.50	7.00
L	12.60	13.08	13.60
L1	—	—	3.95
ϕP	3.40	3.70	3.90
Q	2.60	—	3.20

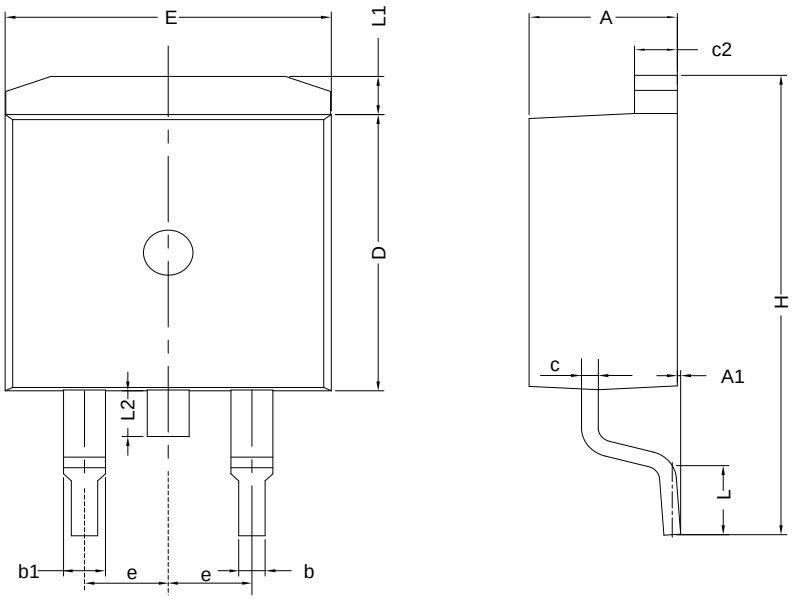
TO-3P **UNIT: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.4	—	5.2
c1	1.2	—	1.8
A1	1.2	—	2.0
b	0.7	1.0	1.3
b1	2.7	3.0	3.3
b2	1.7	2.0	2.3
D	15.0	15.5	16.0
c	0.4	0.6	0.8
F2	8.5	—	10.0
e	5.45 TYP		
L1	22.6	—	23.6
L	39.0	—	41.5
L2	19.5	—	21.0
P	3.0	—	3.4

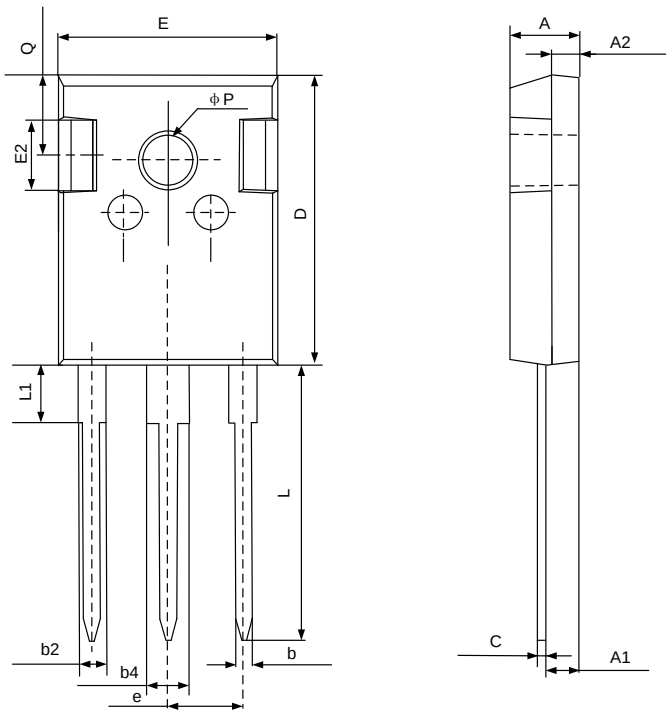
PACKAGE OUTLINE(CONTINUED)

TO-263-2L **UNIT: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.30	4.57	4.72
A1	0	0.10	0.25
b	0.71	0.81	0.91
b1	1.17	—	1.50
c	0.30	—	0.60
c2	1.17	1.27	1.37
D	8.50	—	9.35
E	9.80	—	10.45
e	2.54BSC		
H	14.70	—	15.75
L	2.00	2.30	2.74
L1	1.12	1.27	1.42
L2	—	—	1.75

TO-247-3L **UNIT: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	–	1.36
b2	1.91	–	2.25
b4	2.91	–	3.25
c	0.51	–	0.75
D	20.80	21.00	21.30
E	15.50	15.80	16.10
E2	4.40	5.00	5.20
e	5.44 BSC		
L	19.72	19.92	20.22
L1	–	–	4.30
Q	5.60	5.80	6.00
P	3.40	—	3.80

Important notice :

1. **The instructions are subject to change without notice!**
2. **Customers should obtain the latest relevant information before placing orders and should verify that such information is complete and current. Please read the instructions carefully before using our products, including the circuit operation precautions.**
3. **Our products are consumer electronic products or the other civil electronic products.**
4. **When using our products, please do not exceed the maximum rating of the products, otherwise the reliability of the whole machine will be affected. There is a certain possibility of failure or malfunction of any semiconductor product under specific conditions. The buyer is responsible for complying with safety standards and taking safety measures when using our products for system design, sample and whole machine manufacturing, so as to avoid potential failure risk that may cause personal injury or property loss.**
5. **It is strongly recommended to identify the trademark when buying our products. Please contact us if there is any question.**
6. **Product promotion is endless, our company will wholeheartedly provide customers with better products!**
7. **Website: http: //www.silan.com.cn**

Part No.:	SVSP20N60FJD(K)(T)(PN)(S)(P7)D2	Document Type:	Datasheet
Copyright:	HANGZHOU SILAN MICROELECTRONICS CO.,LTD	Website:	http: //www.silan.com.cn

Rev.: 1.3

Revision History:

1. Add figures 2, 5, 6, and 13
2. Update figure 4 and figure 8
3. Update package outline of TO-3P, TO-263-2L, TO-247-3L
4. Update curve template
5. Update typical test circuit
6. Update important notice

Rev.: 1.2

Revision History:

1. Modify Electrical schematic and TYPICAL TEST CIRCUIT

Rev.: 1.1

Revision History:

1. Update TYPICAL TEST CIRCUIT

Rev.: 1.0

Revision History:

1. First release