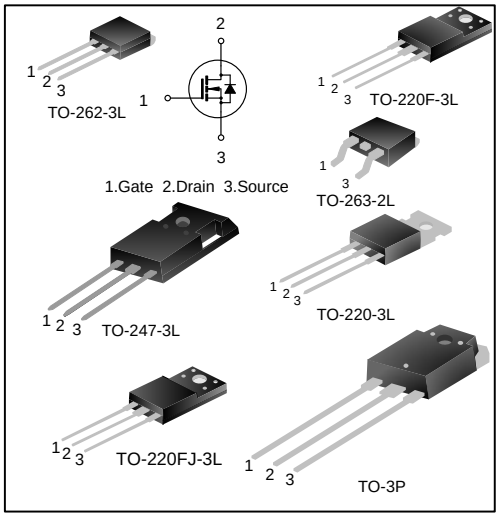
20A, 600V SUPER JUNCTION MOS POWER TRANSISTOR

GENERAL DESCRIPTION

SVS20N60FJ(K)(T)(PN)(S)(P7)(F)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
SVS20N60FJD2	TO-220FJ-3L	20N60FJD2	Halogen free	Tube
SVS20N60KD2	TO-262-3L	20N60KD2	Halogen free	Tube
SVS20N60TD2	TO-220-3L	20N60TD2	Halogen free	Tube
SVS20N60PND2	TO-3P	20N60PND2	Pb free	Tube
SVS20N60SD2	TO-263-2L	20N60SD2	Halogen free	Tube
SVS20N60SD2TR	TO-263-2L	20N60SD2	Halogen free	Tape&Reel
SVS20N60P7D2	TO-247-3L	20N60P7D2	Pb free	Tube
SVS20N60FD2	TO-220F-3L	20N60FD2	Halogen free	Tube

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

Characteristics		Symbol	Ratings			Unit
			SVS20N60 FJD2/FD2	SVS20N60 KD2/TD2/SD2	SVS20N60 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		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
		SVS20N60 FJD2/FD2	SVS20N60 KD2/TD2/SD2	SVS20N60 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	Tj=25°C	--	0.16	0.19	Ω
			Tj=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

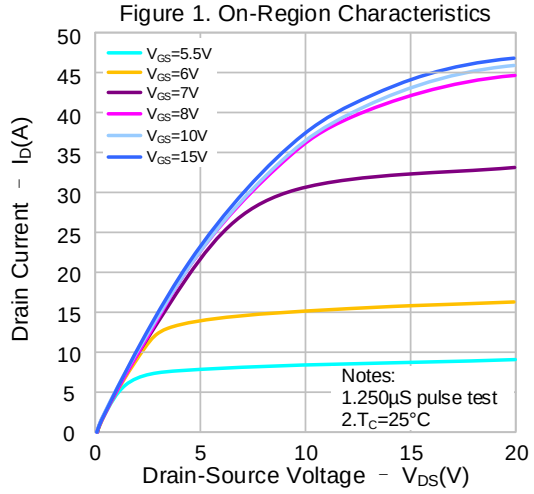


Figure 2. Transfer Characteristics

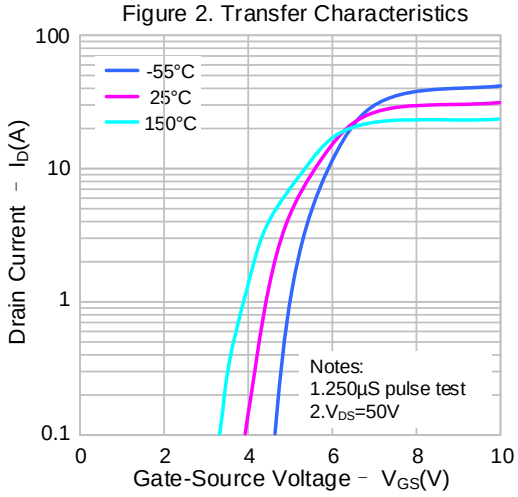


Figure 3. On-Resitance Variation vs. Drain Current

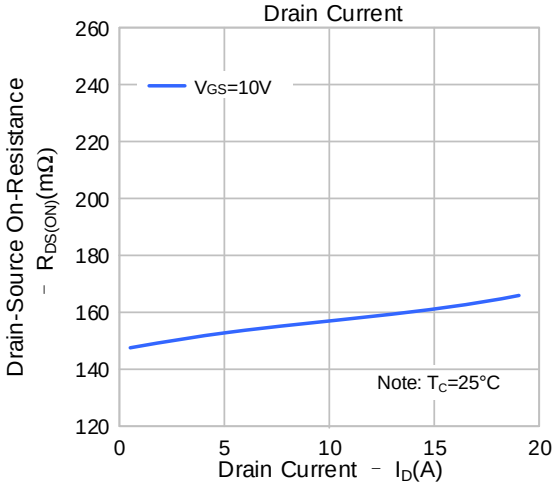


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

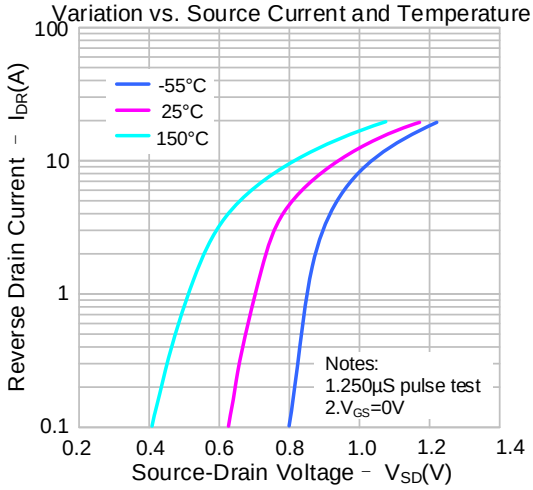


Figure 5. Capacitance Characteristics

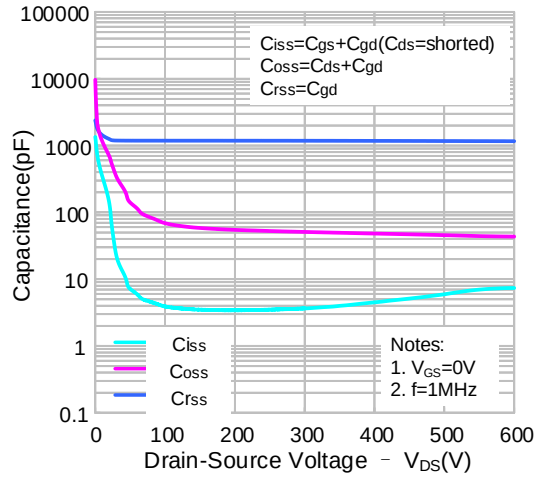
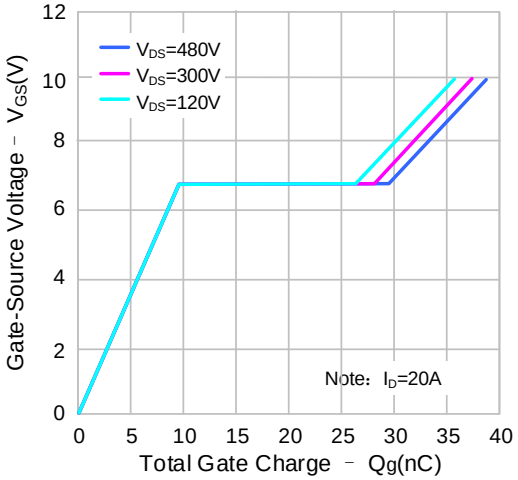


Figure 6. Gate Charge Characteristics



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 7. Breakdown Voltage Variation vs. Temperature

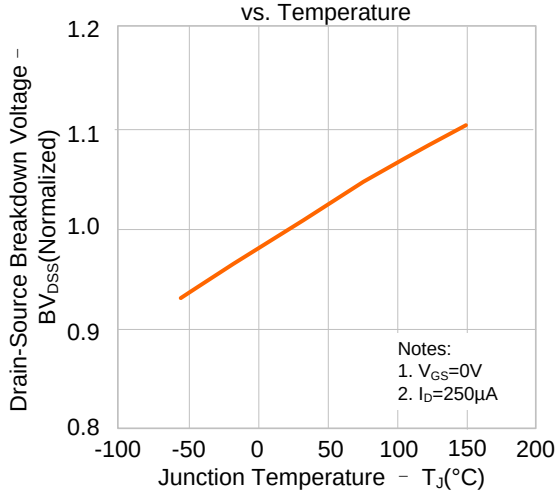


Figure 8. On-resistance Variation vs. Temperature

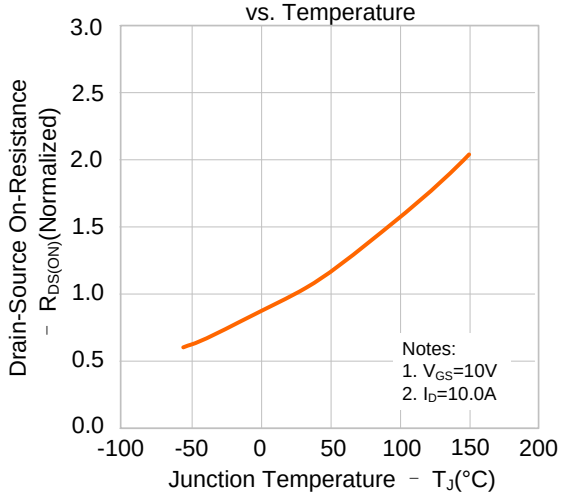


Figure 9-1. Max. Safe Operating Area (SVS20N60FJD2/FD2)

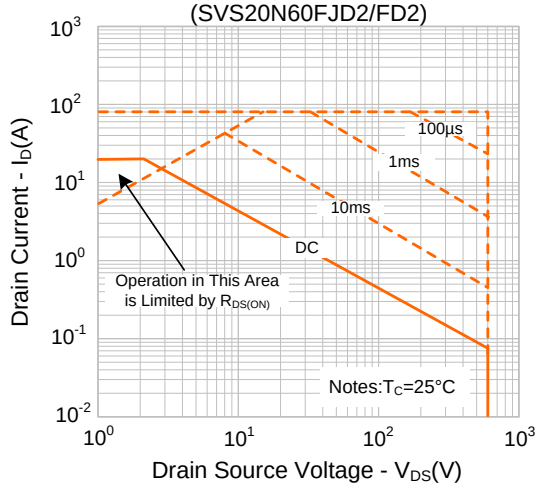


Figure 9-2. Max. Safe Operating Area (SVS20N60KD2/TD2/SD2)

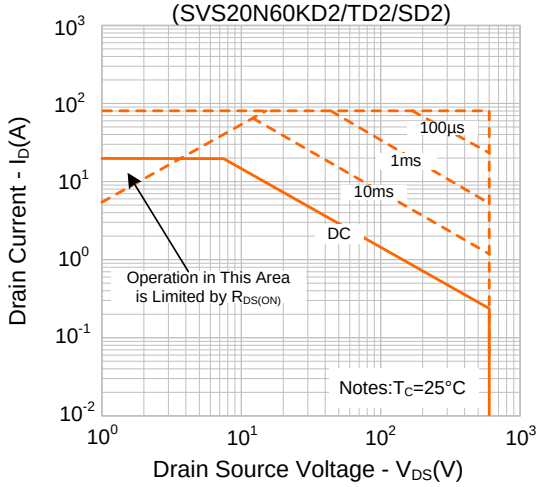
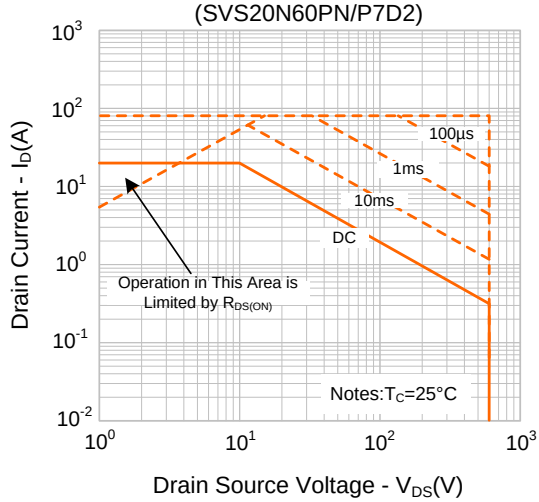
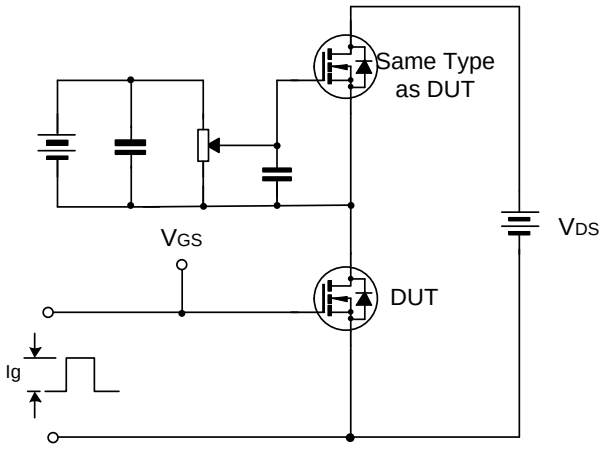


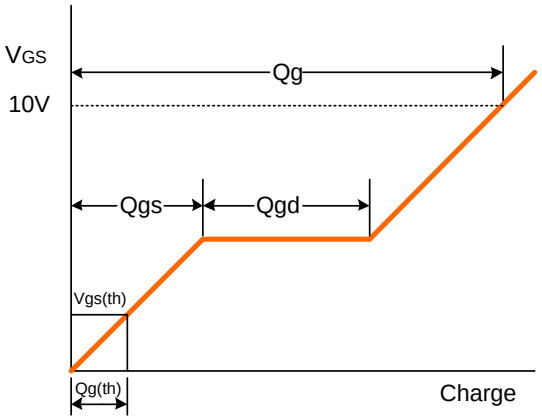
Figure 9-3. Max. Safe Operating Area (SVS20N60PN/P7D2)



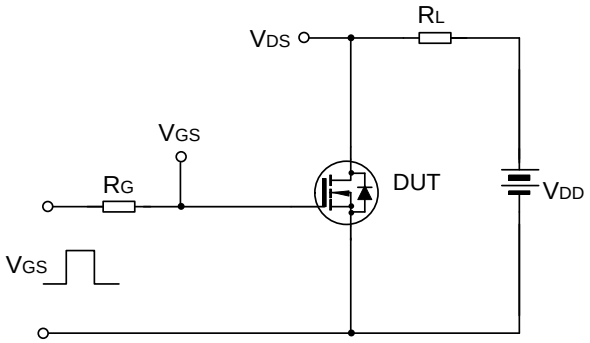
TYPICAL TEST CIRCUIT

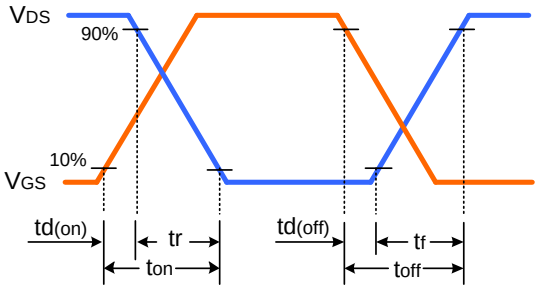
Gate Charge Test Circuit & Waveform



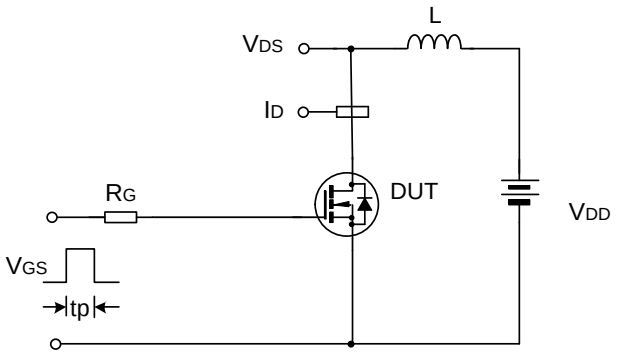


Resistive Switching Test Circuit & Waveform

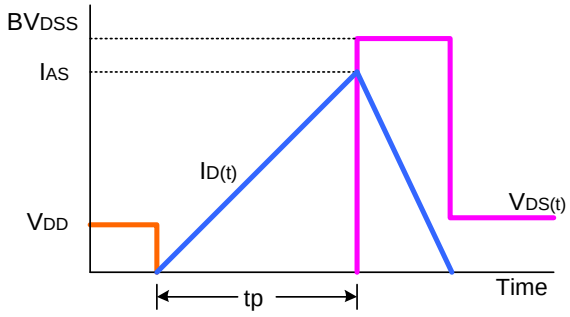




Unclamped Inductive Switching Test Circuit & Waveform

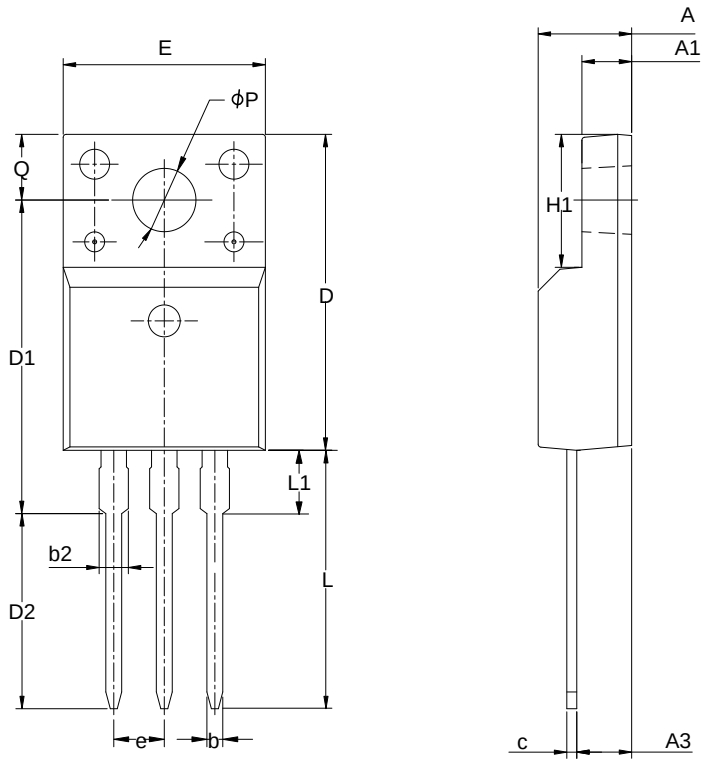


$$E_{AS} = \frac{1}{2} LI_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



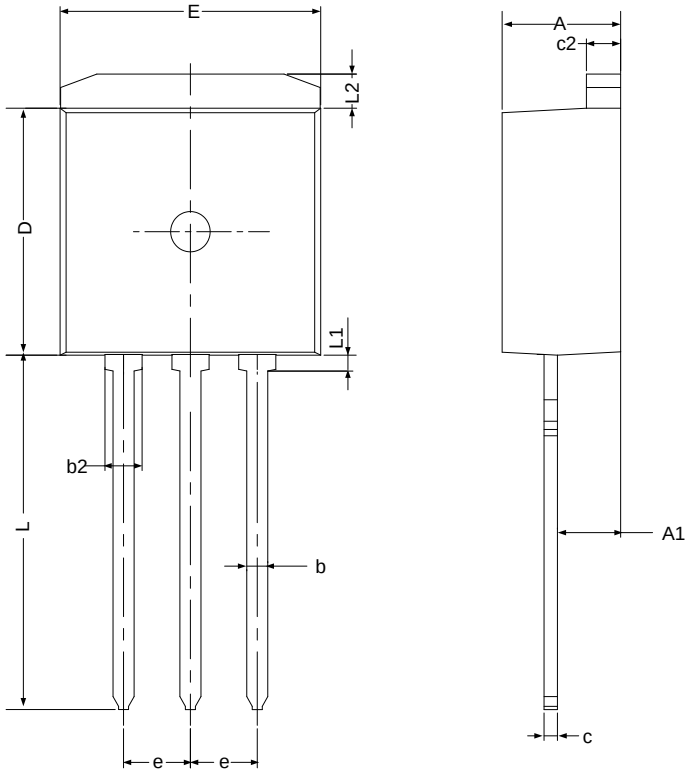
PACKAGE OUTLINE

TO-220FJ-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

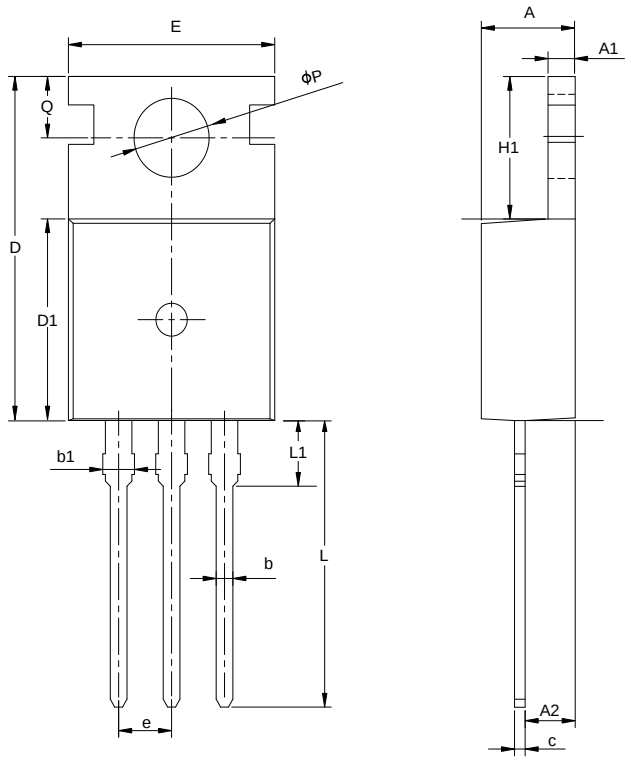
TO-262-3L **UNIT: mm**



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

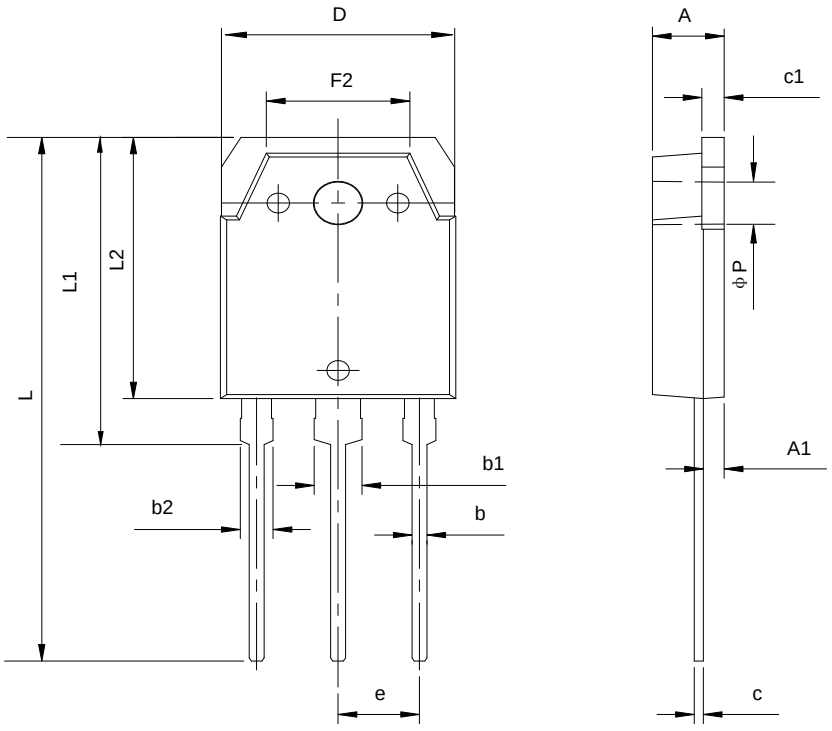
PACKAGE OUTLINE(CONTINUED)

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

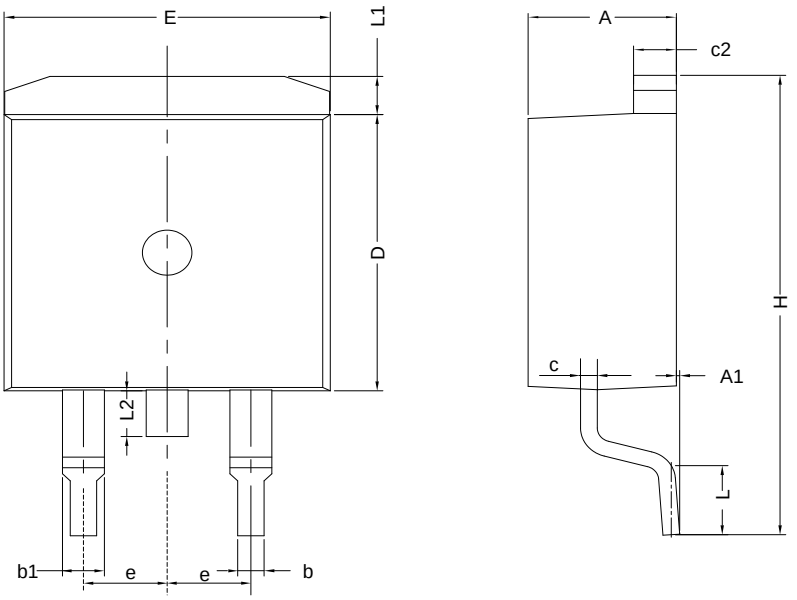
TO-3P **UNIT: mm**



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

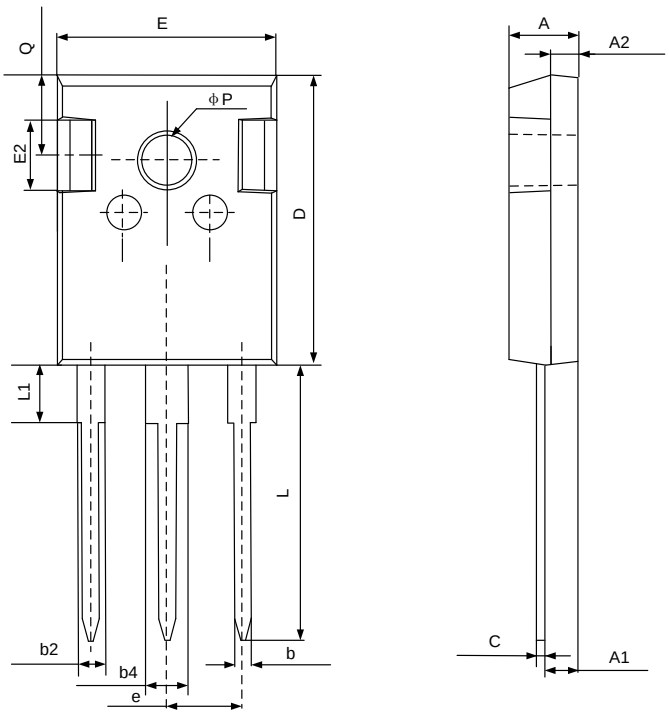
PACKAGE OUTLINE(CONTINUED)

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

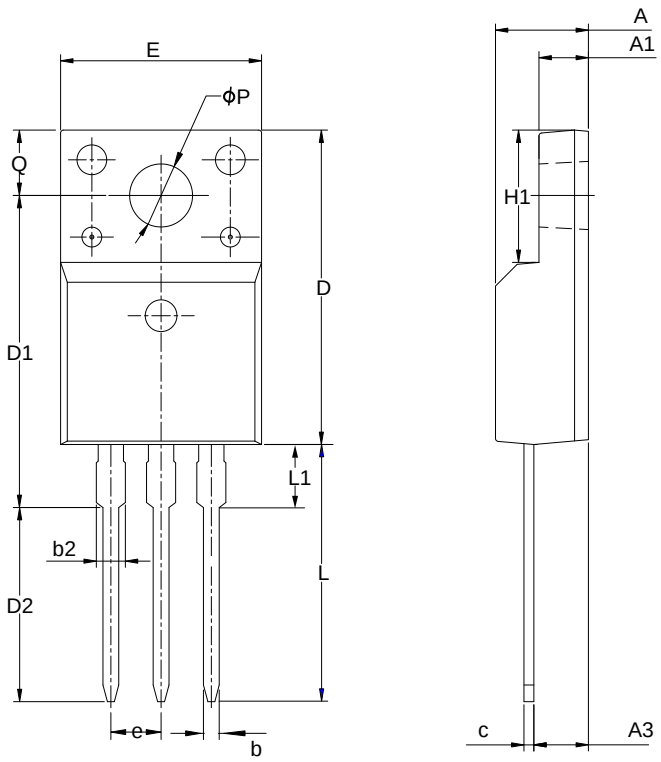
TO-247-3L **UNIT: mm**



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

PACKAGE OUTLINE(CONTINUED)

TO-220F-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	0.70	0.80	0.90
b2	–	–	1.47
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	15.30	15.75	16.30
D2	9.30	9.80	10.30
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	–	–	3.50
ϕP	3.00	3.18	3.40
Q	3.05	3.30	3.55

Important notice :

1. Silan reserves the right to make changes of this instruction without notice.
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Rev.: 1.7

Revision History:

1. Update package outline of TO-263-2L
2. Modify typical test circuit
3. Update the important notice

Rev.: 1.6

Revision History:

1. Add TO-220F-3L
2. Update the template of datasheet

Rev.: 1.5

Revision History:

1. Modify Electrical schematic and TYPICAL TEST CIRCUIT
2. Update the package outline of TO-247-3L
3. Update the package outline of TO-3P

Rev.: 1.4

Revision History:

1. Add dv/dt of ABSOLUTE MAXIMUM RATINGS

Rev.: 1.3

Revision History:

1. Add the package outline of TO-247-3L
2. Modify Electrical characteristics and all curves

Rev.: 1.2

Revision History:

1. Add the package outline of TO-263-2L

Rev.: 1.1

Revision History:

1. Update characteristics and Fig5,Fig6
2. Update the package outline of TO-262-3L

Rev.: 1.0

Revision History:

1. First release