

## 4A, 650V N-CHANNEL MOSFET

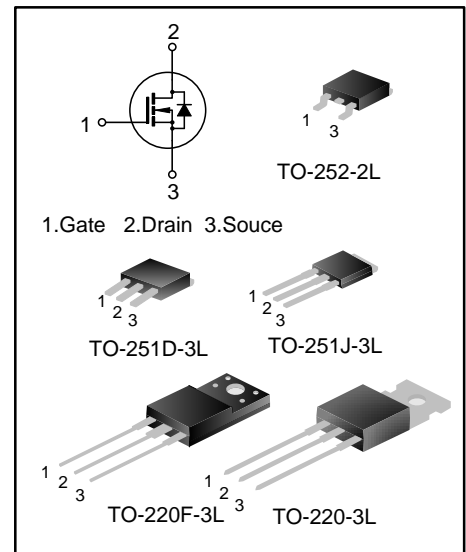
### GENERAL DESCRIPTION

SVF4N65RD/M/MJ/F/T is an N-channel enhancement mode power MOS field effect transistor which is produced using Silan proprietary F-Cell™ high-voltage planar VDMOS technology. The improved process and cell structure have been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.

These devices are widely used in AC-DC power supplies, DC-DC converters and H-bridge PWM motor drivers.

### FEATURES

- ◆ 4A,650V, $R_{DS(on)(typ)}=2.3\Omega@V_{GS}=10V$
- ◆ Low gate charge
- ◆ Low Crss
- ◆ Fast switching
- ◆ Improved dv/dt capability



### ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing Type
SVF4N65RDTR	TO-252-2L	4N65RD	Halogen free	Tape&Reel
SVF4N65RM	TO-251D-3L	4N65RM	Halogen free	Tube
SVF4N65RMJ	TO-251J-3L	4N65RMJ	Halogen free	Tube
SVF4N65RF	TO-220F-3L	SVF4N65RF	Halogen free	Tube
SVF4N65RT	TO-220-3L	SVF4N65RT	Pb free	Tube

## ABSOLUTE MAXIMUM RATINGS (T<sub>c</sub>=25°C UNLESS OTHERWISE NOTED)

Characteristics	Symbol	Rating			Unit
		SVF4N65R D/M/MJ	SVF4N65R F	SVF4N65R T	
Drain-Source Voltage	V <sub>DS</sub>	650			V
Gate-Source Voltage	V <sub>GS</sub>	±30			V
Drain Current	I <sub>D</sub>	T <sub>C</sub> =25°C			A
		T <sub>C</sub> =100°C			
Drain Current Pulsed	I <sub>DM</sub>	16			A
Power Dissipation(T <sub>C</sub> =25°C) -Derate above 25°C	P <sub>D</sub>	77	30	100	W
		0.62	0.24	0.80	W/°C
Single Pulsed Avalanche Energy (Note 1)	E <sub>AS</sub>	215			mJ
Operation Junction Temperature Range	T <sub>J</sub>	-55~+150			°C
Storage Temperature Range	T <sub>stg</sub>	-55~+150			°C

## THERMAL CHARACTERISTICS

Characteristics	Symbol	Rating			Unit
		SVF4N65R D/M/MJ	SVF4N65R F	SVF4N65R T	
Thermal Resistance, Junction-to-Case	R <sub>θJC</sub>	1.62	4.17	1.25	°C/W
Thermal Resistance, Junction-to-Ambient	R <sub>θJA</sub>	62.0	62.5	62.5	°C/W

## ELECTRICAL CHARACTERISTICS (T<sub>c</sub>=25°C UNLESS OTHERWISE NOTED)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Drain -Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	650	--	--	V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V	--	--	1.0	μA
Gate-Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V	--	--	±100	nA
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> =250μA	2.0	--	4.0	V
Static Drain- Source On State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =2.0A	--	2.3	2.7	Ω
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz	--	440	--	pF
Output Capacitance	C <sub>oss</sub>		--	50	--	
Reverse Transfer Capacitance	C <sub>rss</sub>		--	4.0	--	
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =325V, V <sub>GS</sub> =10V, R <sub>G</sub> =25Ω, I <sub>D</sub> =4A  (Note2, 3)	--	10	--	ns
Turn-on Rise Time	t <sub>r</sub>		--	26	--	
Turn-off Delay Time	t <sub>d(off)</sub>		--	25	--	
Turn-off Fall Time	t <sub>f</sub>		--	26	--	
Total Gate Charge	Q <sub>g</sub>	V <sub>DD</sub> =520V, V <sub>GS</sub> =10V, I <sub>D</sub> =4A  (Note 2, 3)	--	13	--	nC
Gate-Source Charge	Q <sub>gs</sub>		--	3.0	--	
Gate-Drain Charge	Q <sub>gd</sub>		--	6.3	--	

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Continuous Source Current	I <sub>S</sub>	Integral Reverse P-N Junction Diode in the MOSFET	--	--	4.0	A
Pulsed Source Current	I <sub>SM</sub>		--	--	16	
Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> =4.0A, V <sub>GS</sub> =0V	--	--	1.4	V
Reverse Recovery Time	T <sub>rr</sub>	I <sub>S</sub> =4.0A, V <sub>GS</sub> =0V, dI <sub>F</sub> /dt=100A/μs (Note 2)	--	450	--	ns
Reverse Recovery Charge	Q <sub>rr</sub>		--	1.9	--	μC

**Notes:**

- L=30mH, I<sub>AS</sub>=3.6A, V<sub>DD</sub>=100V, R<sub>G</sub>=25Ω, starting T<sub>J</sub>=25°C;
- Pulse Test: Pulse width ≤300μs, Duty cycle ≤2%;
- Essentially independent of operating temperature.

**TYPICAL CHARACTERISTICS**

Figure 1. On-Region Characteristics

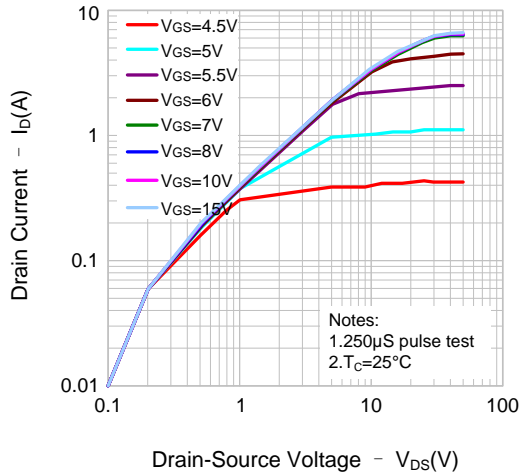


Figure 2. Transfer Characteristics

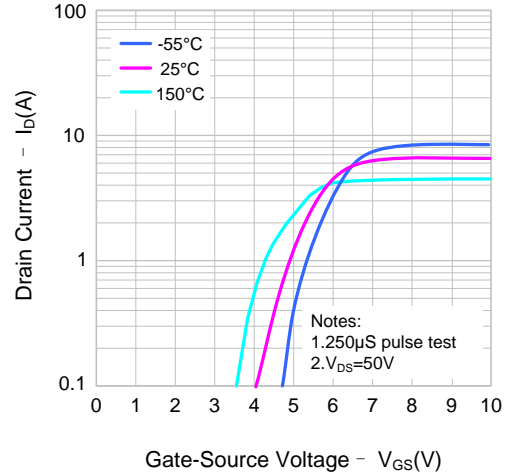


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

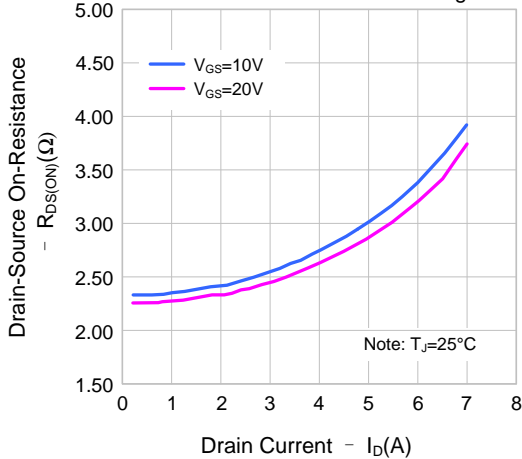


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

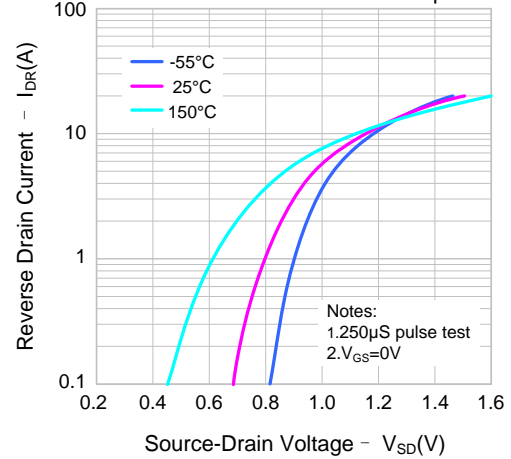


Figure 5. Capacitance Characteristics

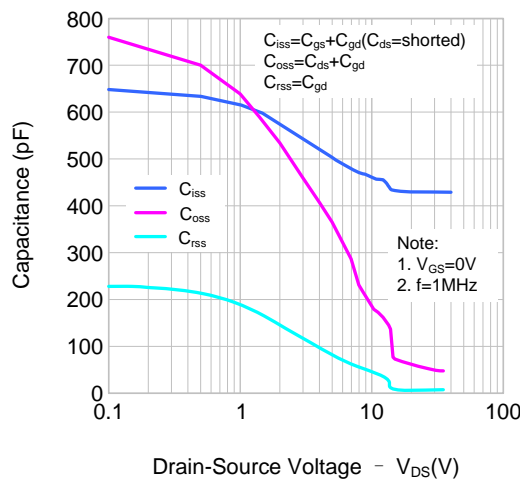
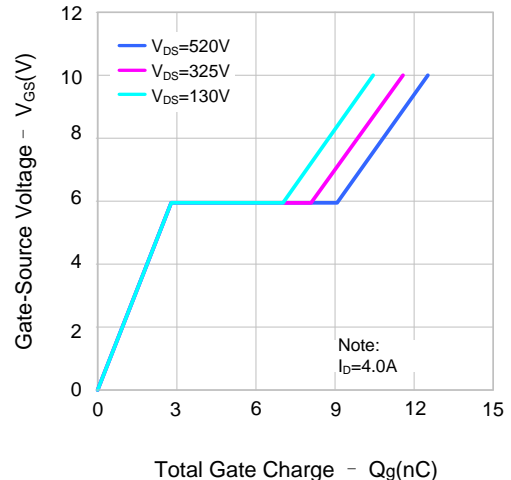


Figure 6. Gate Charge Characteristics



**TYPICAL CHARACTERISTICS (CONTINUED)**

Figure 7. Breakdown Voltage Variation vs. Temperature

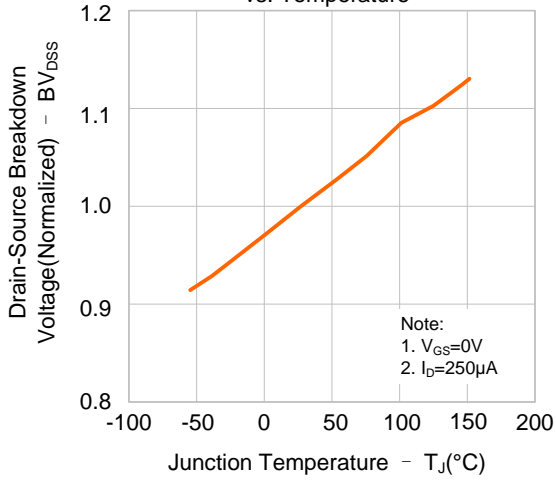


Figure 8. On-resistance Variation vs. Temperature

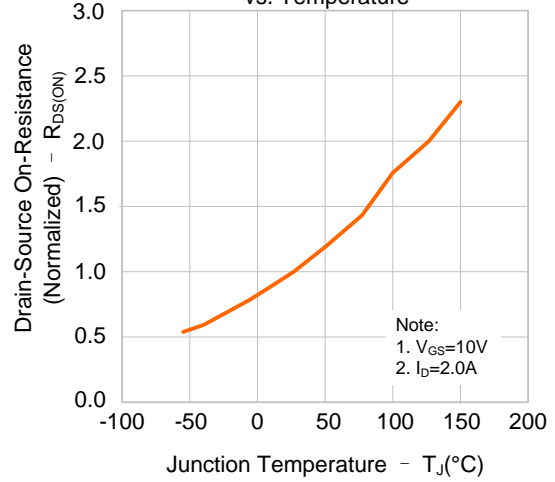


Figure 9-1. Max. Safe Operating Area (SVF4N65RD/M/MJ)

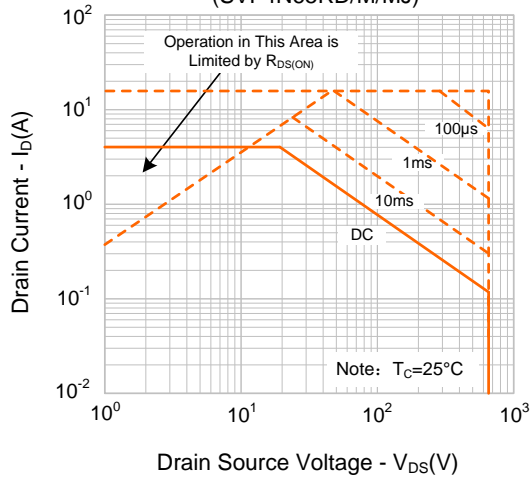


Figure 9-2. Max. Safe Operating Area (SVF4N65RF)

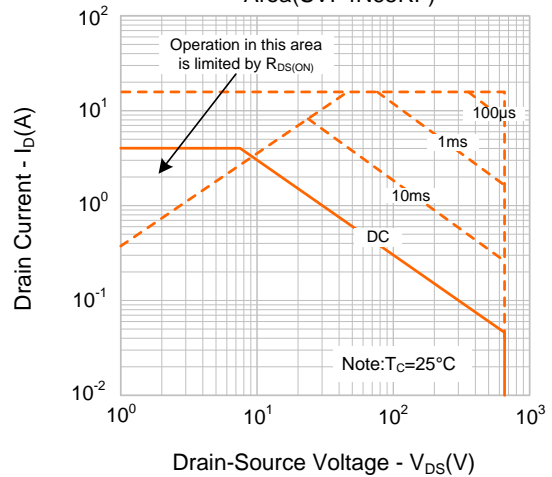


图9-3. Max. Safe Operating Area (SVF4N65RT)

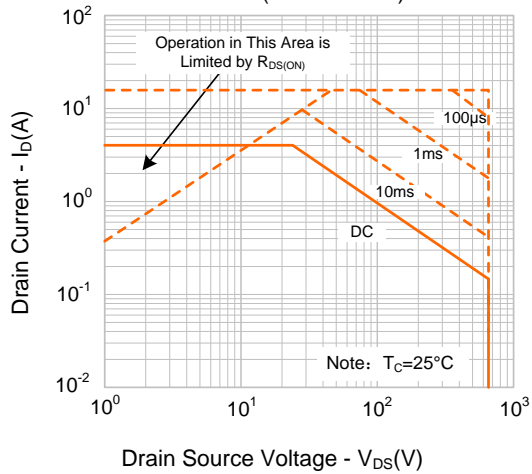
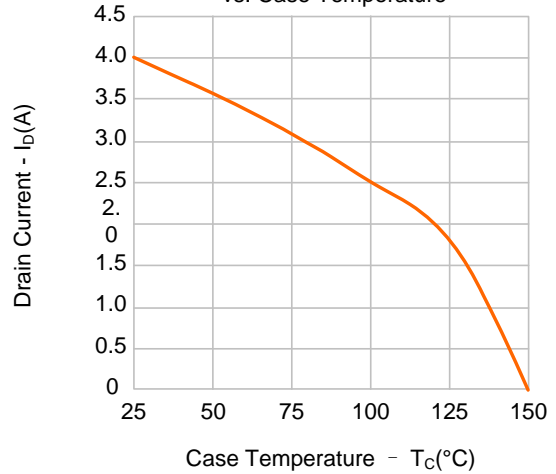
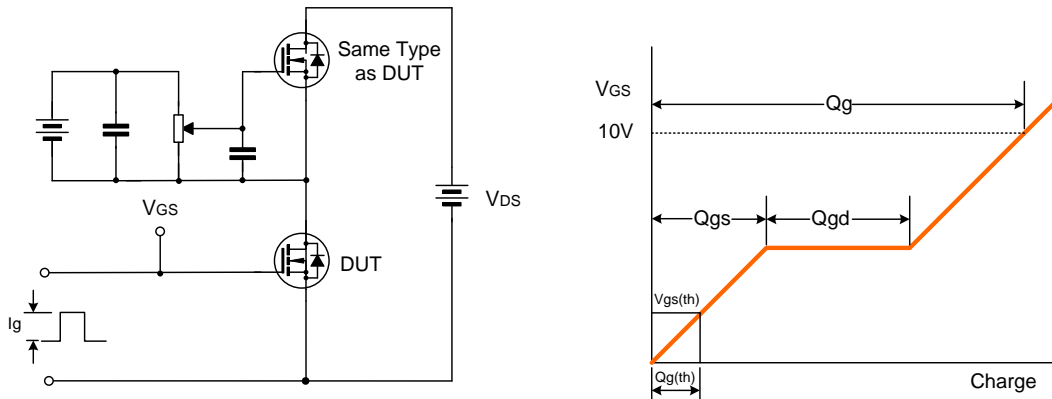


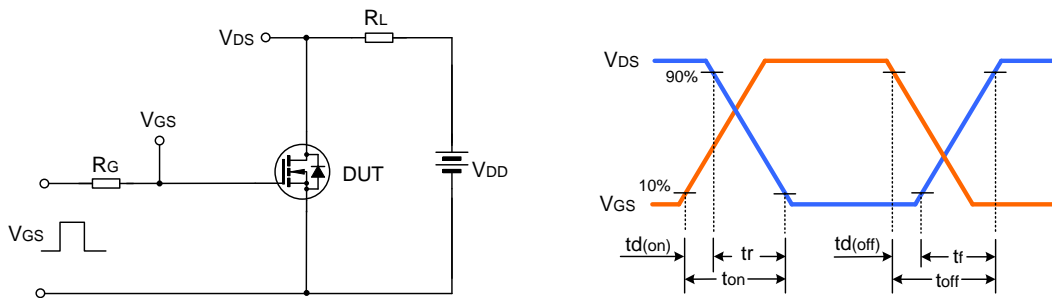
Figure 10. Maximum Drain Current vs. Case Temperature



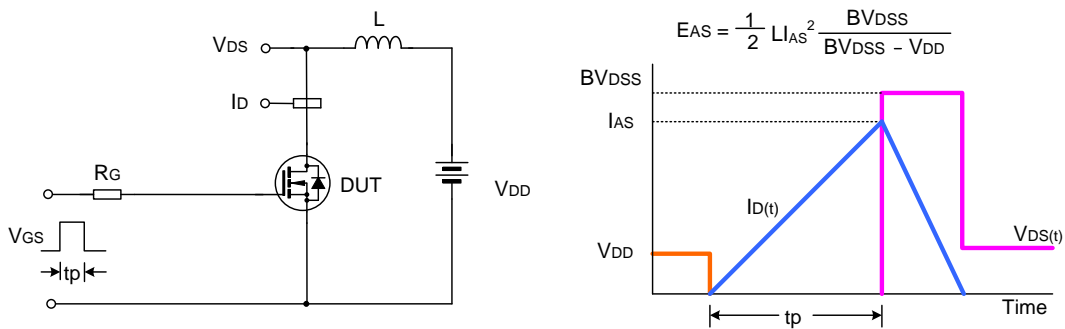
**TYPICAL TEST CIRCUIT**



Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform

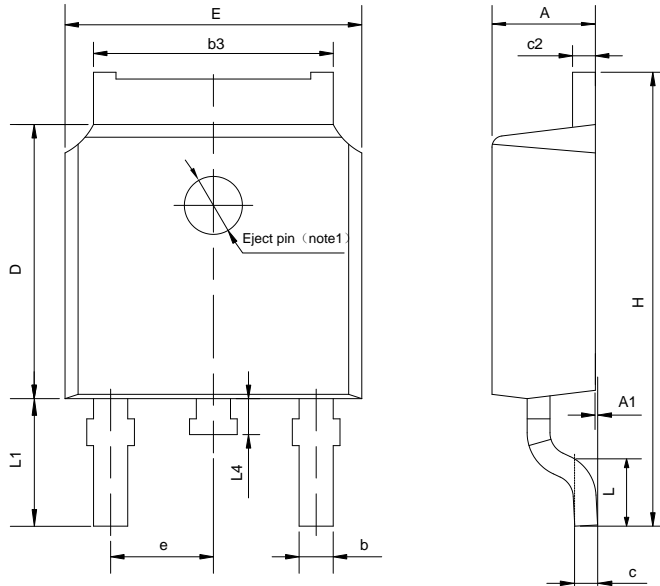


Unclamped Inductive Switching Test Circuit & Waveform

**PACKAGE OUTLINE**

**TO-252-2L**

**UNIT: mm**

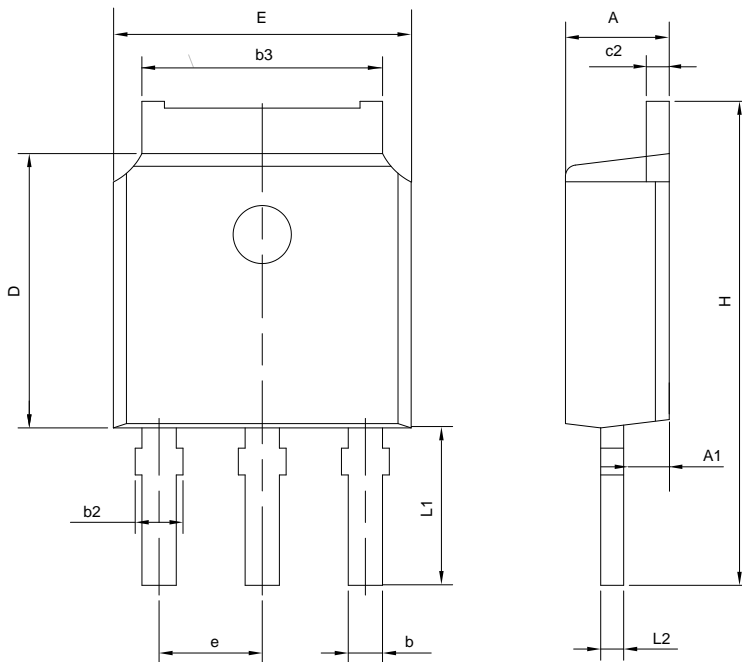


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	2.10	2.30	2.50
A1	0	—	0.127
b	0.66	0.76	0.89
b3	5.10	5.33	5.46
c	0.45	—	0.65
c2	0.45	—	0.65
D	5.80	6.10	6.40
E	6.30	6.60	6.90
e	2.30TYP		
H	9.60	10.10	10.60
L	1.40	1.50	1.70
L1	2.90REF		
L4	0.60	0.80	1.00

**NOTE1** : There are two conditions for this position:has an eject pin or has no eject pin.

**TO-251D-3L**

**UNIT: mm**

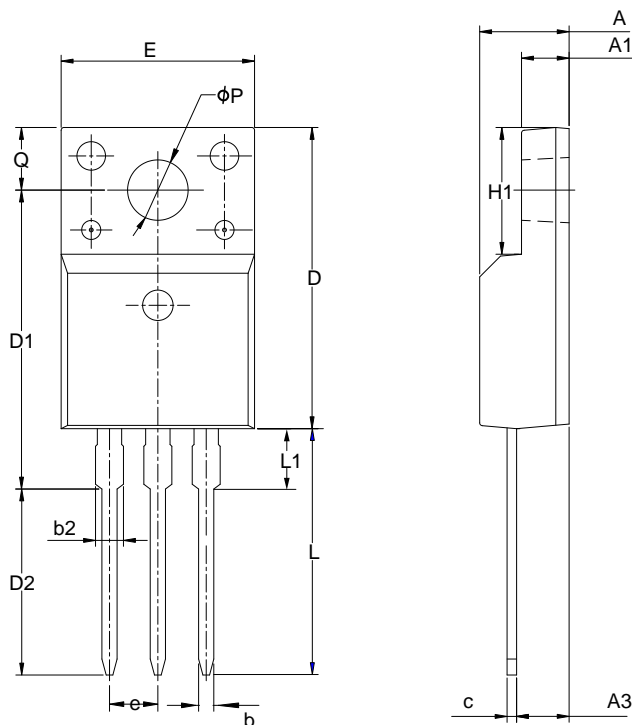


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	2.20	2.30	2.40
b	0.66	—	0.86
b2	0.72	—	0.90
b3	5.10	5.33	5.46
c2	0.46	—	0.60
D	6.00	6.10	6.20
E	6.50	6.60	6.70
e	2.186	2.286	2.386
H	10.40	10.70	11.00
L1	3.50 REF		
L2	0.508 BSC		

**PACKAGE OUTLINE (CONTINUED)**

**TO-220F-3L**

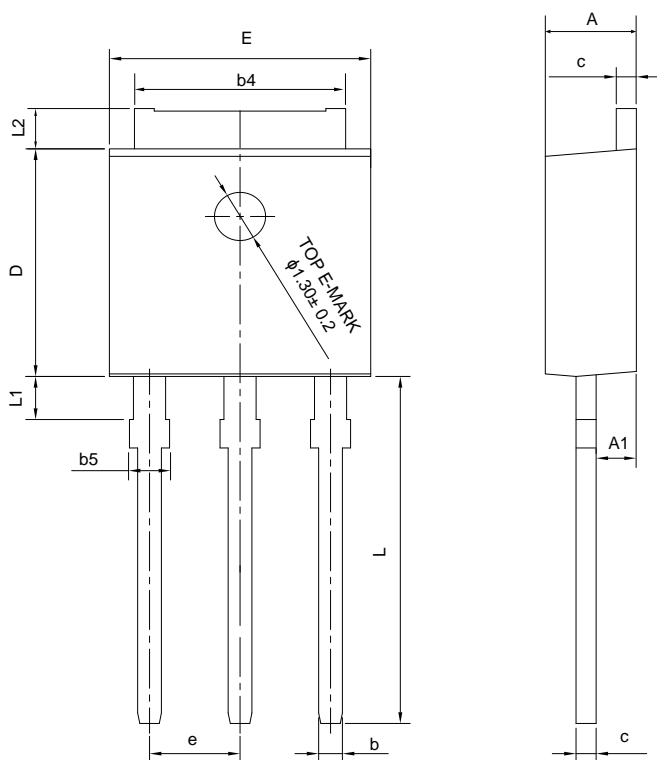
**UNIT: mm**



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
phi P	3.00	3.18	3.40
Q	3.05	3.30	3.55

**TO-251J-3L**

**UNIT: mm**



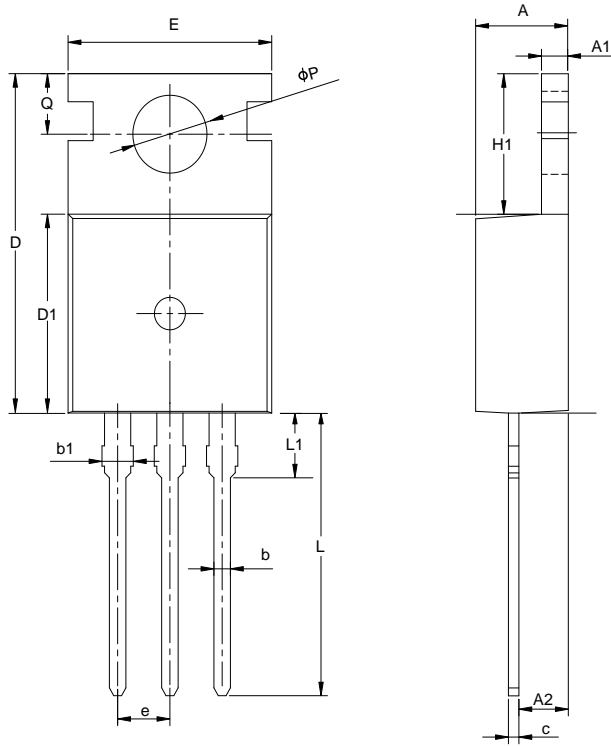
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	2.18	2.30	2.39
A1	0.89	1.00	1.14
b	0.56	—	0.89
b4	4.95	5.33	5.46
b5	—	—	1.05
c	0.46	—	0.61
D	5.97	6.10	6.27
E	6.35	6.60	6.73
e	2.29 BCS		
L	8.89	9.30	9.65
L1	0.95	—	1.50
L2	0.89	—	1.27



**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
phi P	3.40	3.70	3.90
Q	2.60	—	3.20

**Important notice :**

- The instructions are subject to change without notice! Customers should obtain the latest relevant information before placing orders and should verify that such information is complete and current.
- Our products are consumer electronic products, and / or civil electronic products.
- 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.
- It is strongly recommended to identify the trademark when buying our products. Please contact us if there is any question.
- When exporting, using and reselling our products, buyer must comply with the international export control laws and regulations of China, the United States, the United Kingdom, the European Union and other countries & regions.
- Product promotion is endless, our company will wholeheartedly provide customers with better products!
- Website: <http://www.silan.com.cn>

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Part No.: SVF4N65RD/M/MJ/F/T

Document Type: Datasheet

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Rev.: 1.3

Revision History:

1. Deleted NOMENCLATURE
  1. Modify Important notice
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Rev.: 1.2

Revision History:

2. Add SVF4N65RT(To-220-3L) package
  3. Modify electrical diagram and typical circuit diagram
  4. Add an SOA curve for SVF4N65RT
  5. Update the SOA curve of SVF4N65RD(M)(MJ)
  6. Modify ORDERING INFORMATION
  7. Modify TYPICAL TEST CIRCUIT
  8. Modify Important notice
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Rev.: 1.1

Revision History:

1. Add TO-220F-3L
  2. Update characteristics according to Li Min
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Rev.: 1.0

Revision History:

1. First release
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