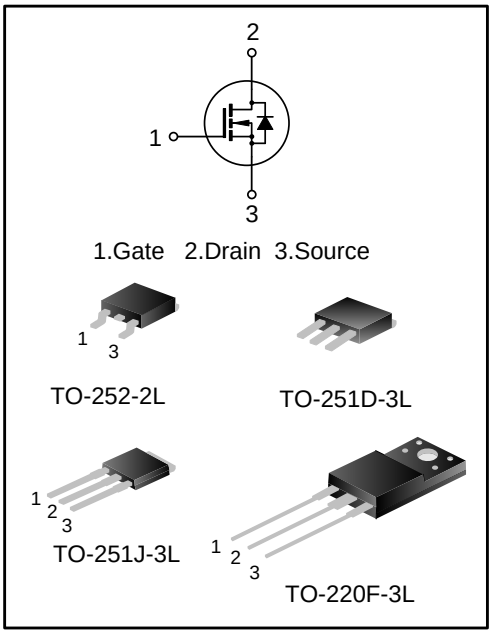
4A, 650V N-CHANNEL MOSFET

DESCRIPTION

SVF4N65F/M/MJ/D is an N-channel enhancement mode power MOS field effect transistor which is produced using Silan proprietary F-Cell™ structure 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, $R_{DS(on)(typ.)}$=2.3Ω@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
SVF4N65F	TO-220F-3L	SVF4N65F	Pb free	Tube
SVF4N65MJ	TO-251J-3L	SVF4N65MJ	Halogen free	Tube
SVF4N65M	TO-251D-3L	SVF4N65M	Halogen free	Tube
SVF4N65DTR	TO-252-2L	SVF4N65D	Halogen free	Tape&Reel

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

Characteristics		Symbol	Ratings			Unit
			SVF4N65F	SVF4N65MJ	SVF4N65M/D	
Drain-Source Voltage		V_{DS}	650			V
Gate-Source Voltage		V_{GS}	±30			V
Drain Current	T_C=25°C	I_D	4.0			A
	T_C=100°C		2.5			
Drain Current Pulsed		I_{DM}	16			A
Power Dissipation (T_C=25°C)		P_D	30	79	77	W
-Derate above 25°C			0.24	0.63	0.62	W/°C
Single Pulsed Avalanche Energy (Note1)		E_{AS}	215			mJ
Operation Junction Temperature Range		T_J	-55～+150			°C
Storage Temperature Range		T_{stg}	-55～+150			°C

THERMAL CHARACTERISTICS

Characteristics	Symbol	Ratings			Unit
		SVF4N65F	SVF4N65MJ	SVF4N65M/D	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	4.17	1.58	1.62	°C/W
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	62.5	62.0	62.0	°C/W

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

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Drain -Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=250μA	650	--	--	V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=650V, 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=2A	--	2.3	2.7	Ω
Input Capacitance	C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1.0MHz	--	430	--	pF
Output Capacitance	C_{oss}		--	55	--	
Reverse Transfer Capacitance	C_{rss}		--	4.1	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=325V , V_{GS}=10V , R_G=25Ω , I_D=4A (Notes 2,3)	--	9.9	--	ns
Turn-on Rise Time	t_r		--	26	--	
Turn-off Delay Time	$t_{d(off)}$		--	28	--	
Turn-off Fall Time	t_f		--	26	--	
Total Gate Charge	Q_g	V_{DD}=520V, V_{GS}=10V, I_D=4A (Notes 2,3)	--	13	--	nC
Gate-Source Charge	Q_{gs}		--	2.7	--	
Gate-Drain Charge	Q_{gd}		--	6.3	--	

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Continuous Source Current	I_S	Integral Reverse P-N Junction Diode in the MOSFET	--	--	4.0	A
Pulsed Source Current	I_{SM}		--	--	16	
Diode Forward Voltage	V_{SD}	I_S=4.0A, V_{GS}=0V	--	--	1.4	V
Reverse Recovery Time	T_{rr}	I_S=4.0A, V_{GS}=0V, dI_F/dt=100A/μs (Note 2)	--	450	--	ns
Reverse Recovery Charge	Q_{rr}		--	1.9	--	μC

Notes:

1. L=30mH, I_{AS}=3.6A, V_{DD}=100V, R_G=25Ω, starting T_J=25°C;
2. Pulse Test: Pulse width ≤300μs, Duty cycle≤2%;
3. Essentially independent of operating temperature.

TYPICAL CHARACTERISTICS

Figure 1. On-Region Characteristics

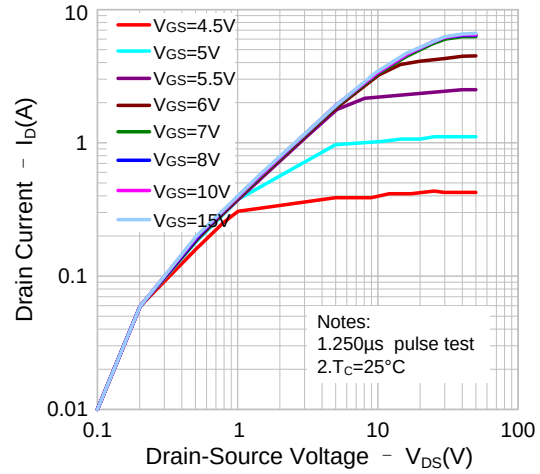


Figure 2. Transfer Characteristics

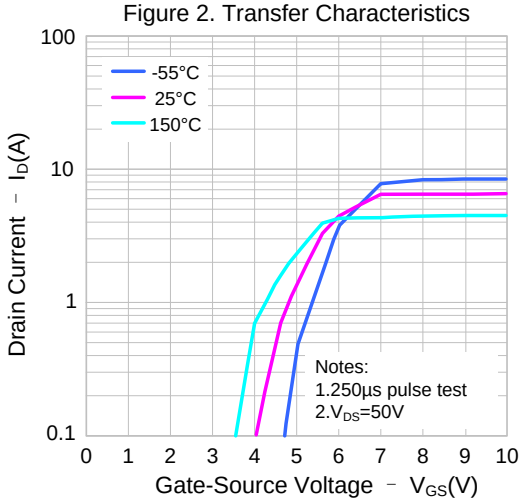


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

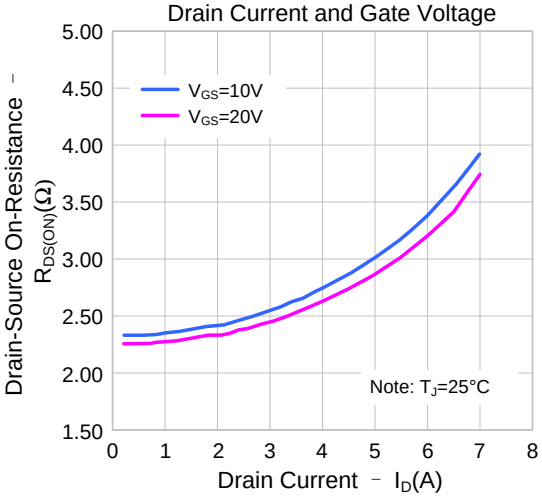


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

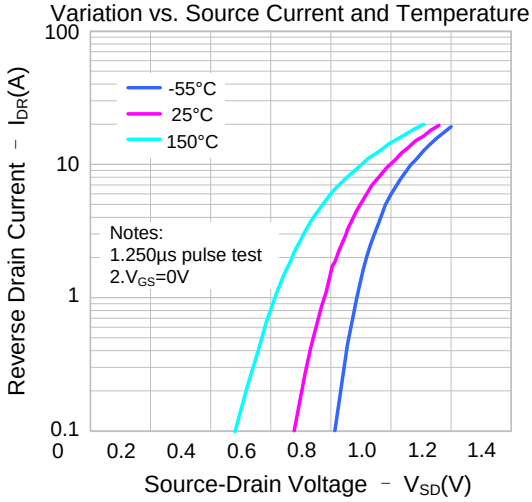


Figure 5. Capacitance Characteristics

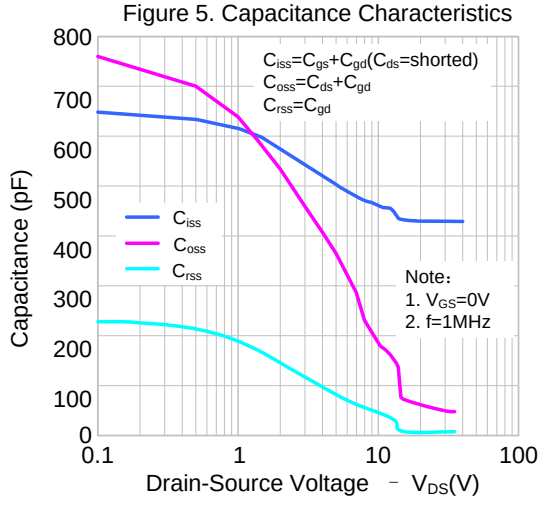
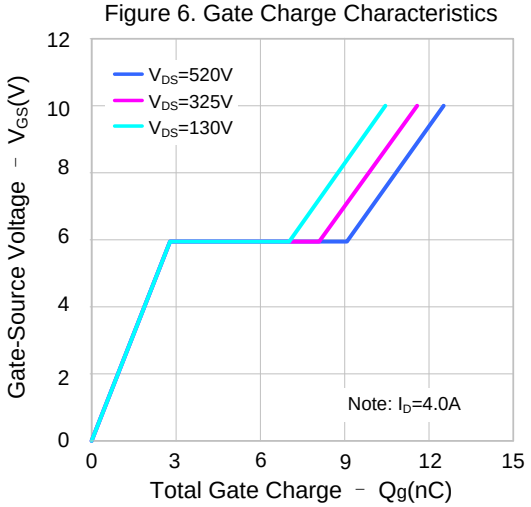


Figure 6. Gate Charge Characteristics



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 7. Breakdown Voltage Variation vs. Temperature

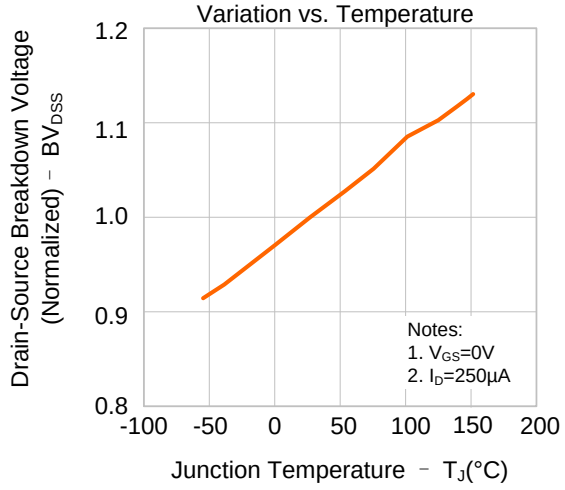


Figure 8. On-resistance vs. Temperature

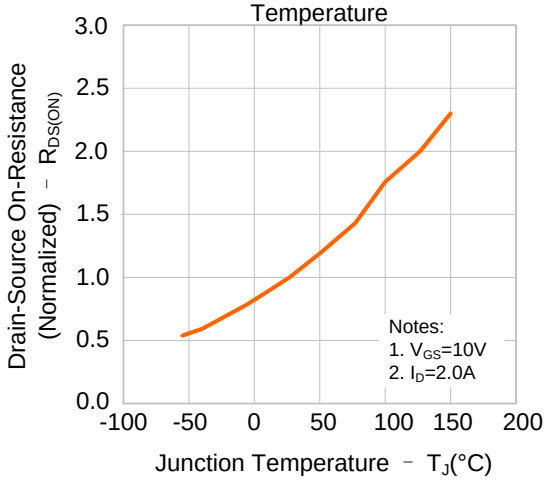


Figure 9-1. Max. Safe Operating Area (SVF4N65F)

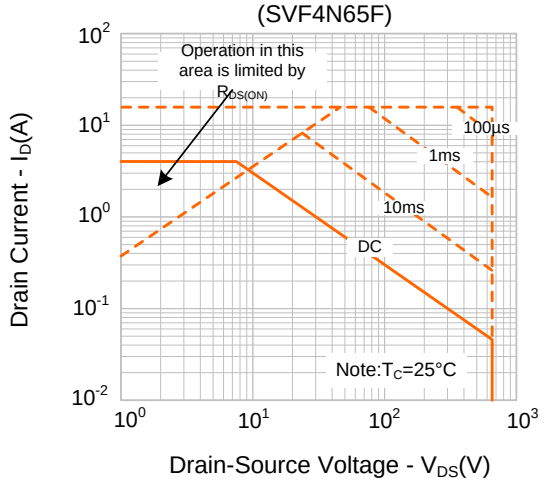


Figure 9-2. Max. Safe Operating Area (SVF4N65M/D)

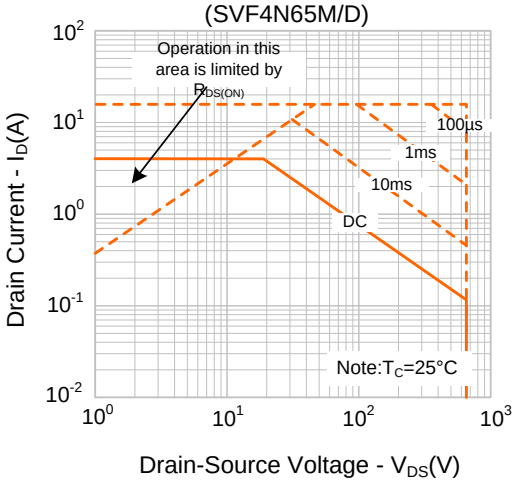


Figure 9-3. Max. Safe Operating Area (SVF4N65MJ)

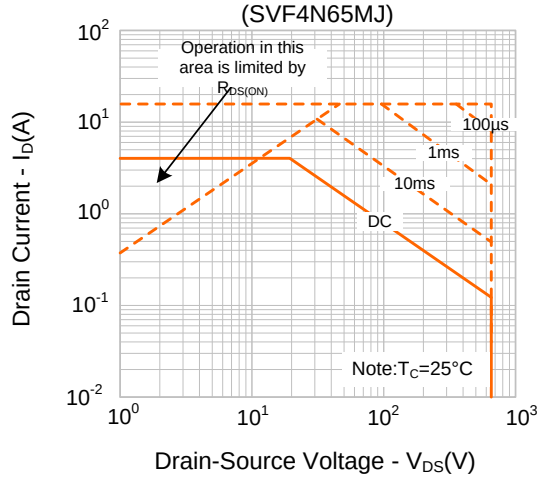
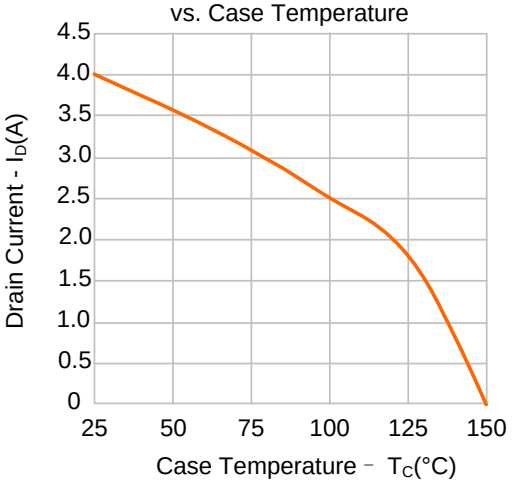
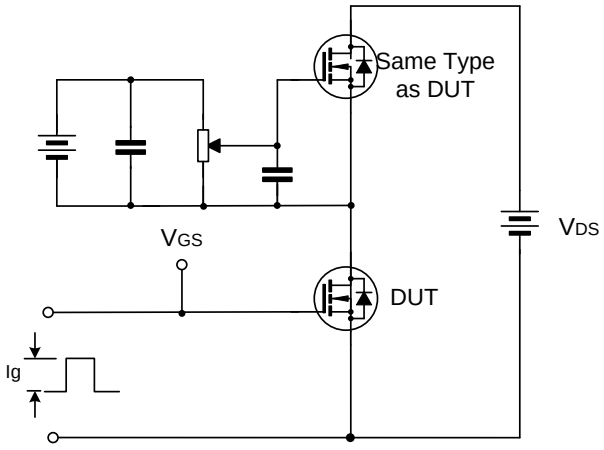


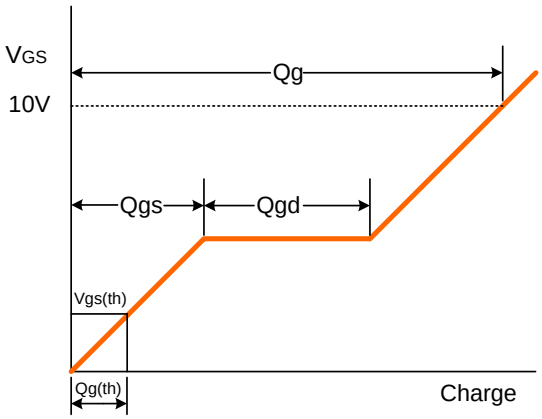
Figure 10. Maximum Drain Current vs. Case Temperature



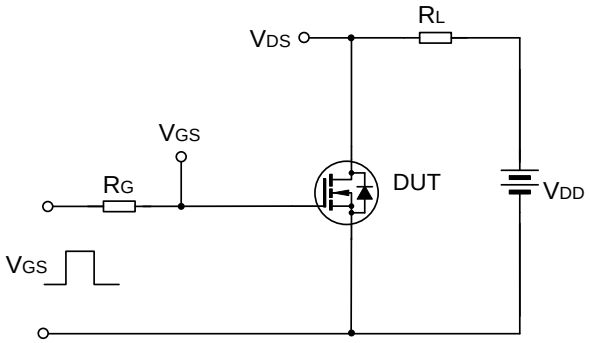
TYPICAL TEST CIRCUIT

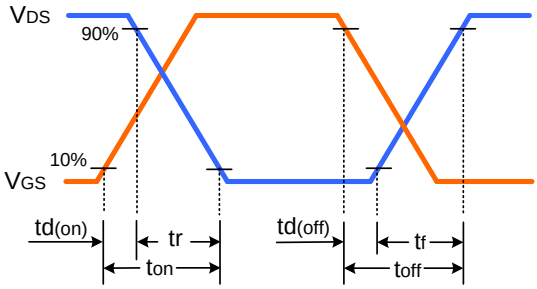
Gate Charge Test Circuit & Waveform



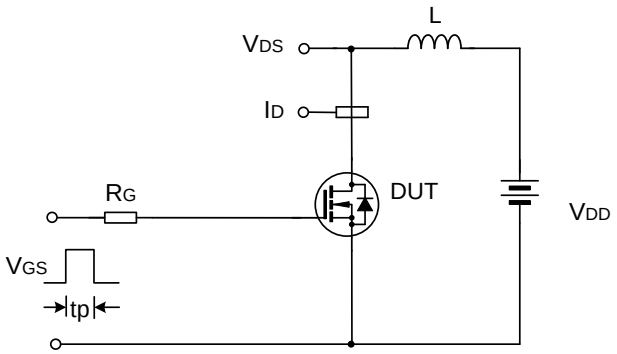


Resistive Switching Test Circuit & Waveform

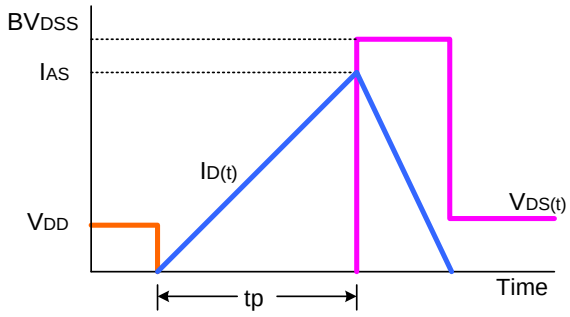




Unclamped Inductive Switching Test Circuit & Waveform

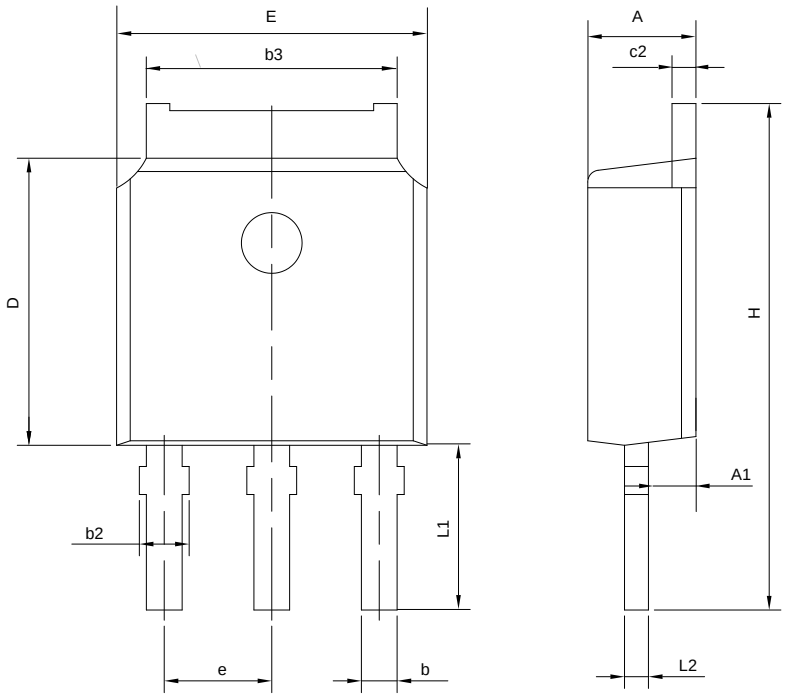


$$E_{AS} = \frac{1}{2} LI_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



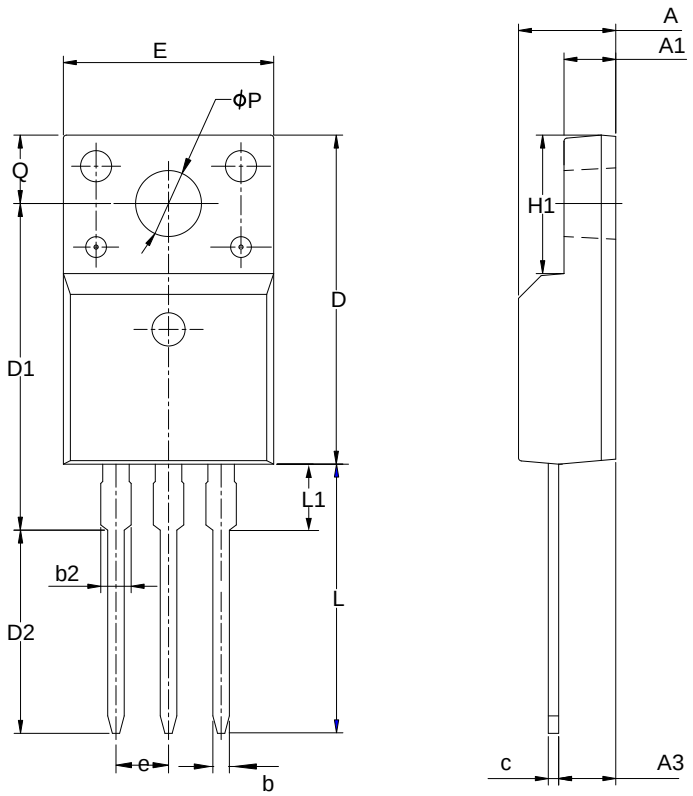
PACKAGE OUTLINE

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		

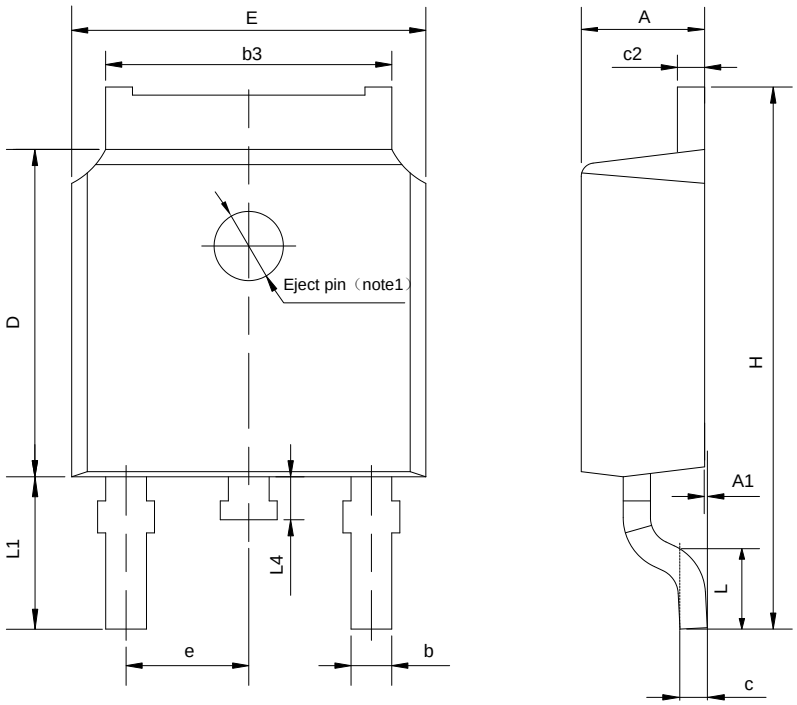
TO-220F-3L **UNIT: mm**



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

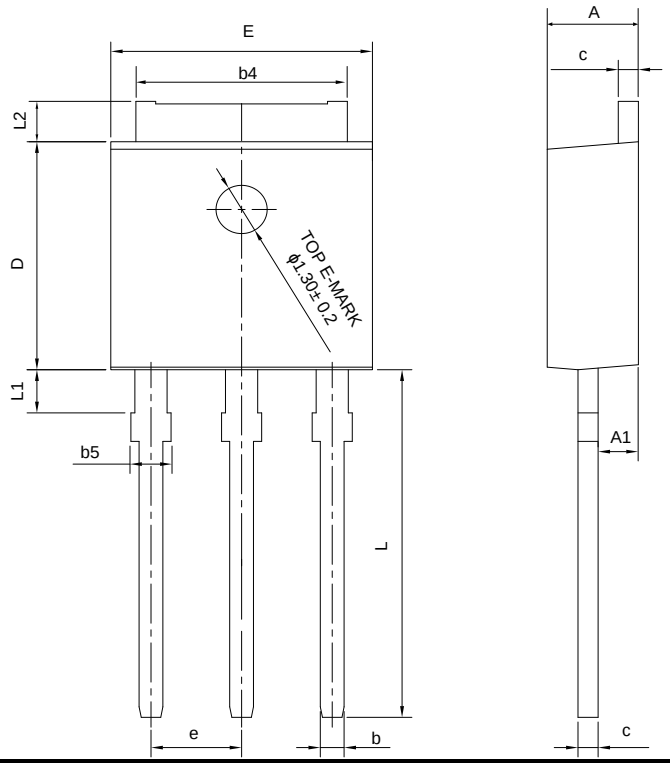
PACKAGE OUTLINE (CONTINUED)

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

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

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Rev.: 3.7

Revision History:

1. Update the electrical diagram and typical test circuit
2. Update the template

Rev.: 3.6

Revision History:

1. Delete the package outline of TO-220-3L and TO-262-3L

Rev.: 3.5

Revision History:

1. Update the package outline of TO-262-3L

Rev.: 3.4

Revision History:

1. Modify the Electrical characteristics and curves according to SVF4N65CA
2. Delete package outline of TO-220F-3L(2)
3. Update the package outline of TO-251J-3L

Rev.: 3.3

Revision History:

1. Modify the Electrical characteristics
2. Delete TO-251-3L

Rev.: 3.2

Revision History:

1. Modify the Hazardous Substance Control of TO-262-3L
2. Modify the package outline of TO-251J-3L（1.1version）and TO-251D-3L（1.5version）

Rev.: 3.1

Revision History:

1. Modify the ordering information
2. Modify the package outline of TO-262-3L

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Rev.: 3.0

Revision History:

1. Modify the ordering information
2. Modify the package information of TO-220-3L

Rev.: 2.9

Revision History:

1. Modify the electrical characteristics G_{fs}
2. Modify the ordering information

Rev.: 2.8

Revision History:

1. Modify the package information of TO-220F-3L
2. Modify the package information of TO-252-2L
3. Modify the package information of TO-220-3L
4. Modify the electrical characteristics G_{fs}

Rev.: 2.7

Revision History:

1. Modify the thermal characteristics

Rev.: 2.6

Revision History:

1. Modify the ordering information

Rev.: 2.5

Revision History:

1. Add the Min. and Max. values of C_{iss}

Rev.: 2.4

Revision History:

1. Modify the ordering information

Rev.: 2.3

Revision History:

1. Modify the package outline of TO-251J-3L

Rev.: 2.2

Revision History:

1. Modify the ordering information

Rev.: 2.1

Revision History:

1. Modify the electrical characteristics and typical characteristics
2. Add the package of TO-251-3L

Rev.: 2.0

Revision History:

1. Change the schematic diagram of MOS

Part No.:	SVF4N65F/M/MJ/D	Document Type:	Datasheet
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Rev.: 1.9

Revision History:

1. Modify the package outline of TO-251D-3L

Rev.: 1.8

Revision History:

1. Modify “PACKAGE OUTLINE”

Rev.: 1.7

Revision History:

1. Modify “ORDERING INFORMATION”

Rev.: 1.6

Revision History:

1. Modify “PACKAGE OUTLINE”

Rev.: 1.5

Revision History:

1. Add the halogen free information of SVF4N65MJ

Rev.: 1.4

Revision History:

1. Add the package of TO-262-3L

Rev.: 1.3

Revision History:

1. Modify the typ. Value of R_{Dson}
2. Delete the package of TO-251-3L, Add the package of TO-251J-3L

Rev.: 1.2

Revision History:

1. Modify the values of T_{rr} and Q_{rr}

Rev.: 1.1

1. Add the package of TO-252-2L and TO-251D-3L

Rev.: 1.0

Revision History:

1. Original