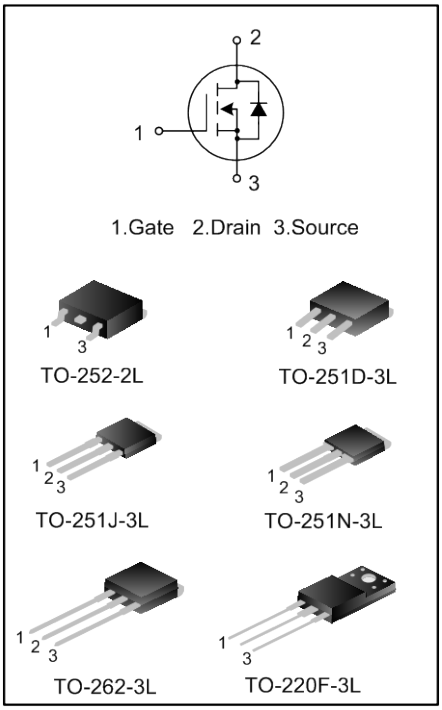
4A, 650V N-CHANNEL MOSFET

GENERAL DESCRIPTION

SVF4N65CAF/D/M/MJ/MN/K 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.

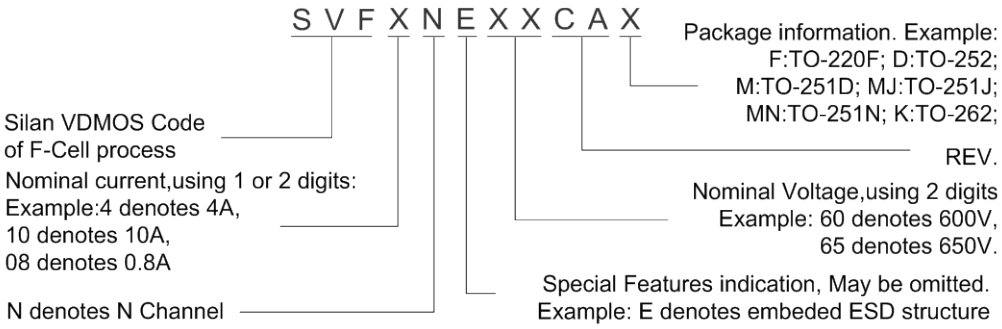
These devices are widely used in AC-DC power supplies, DC-DC converters and H-bridge PWM motor drivers.



FEATURES

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

NOMENCLATURE



ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing
SVF4N65CAF	TO-220F-3L	SVF4N65CAF	Halogen free	Tube
SVF4N65CAD	TO-252-2L	4N65CAD	Halogen free	Tube
SVF4N65CADTR	TO-252-2L	4N65CAD	Halogen free	Tape & Reel
SVF4N65CAM	TO-251D-3L	4N65CAM	Halogen free	Tube
SVF4N65CAMJ	TO-251J-3L	4N65CAMJ	Halogen free	Tube
SVF4N65CAMN	TO-251N-3L	4N65CAMN	Halogen free	Tube
SVF4N65CAK	TO-262-3L	4N65CAK	Halogen free	Tube

ABSOLUTE MAXIMUM RATINGS (TC=25°C, unless otherwise noted)

Characteristics		Symbol	Ratings				Unit
			SVF4N65 CAF	SVF4N65 CAM/D	SVF4N65 CAMJ/MN	SVF4N65 CAK	
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	77	79	90	W
-Derate above 25°C			0.24	0.62	0.63	0.72	W/°C
Single Pulsed Avalanche Energy(Note 1)		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
		SVF4N65 CAF	SVF4N65 CAM/D	SVF4N65 CAMJ/MN	SVF4N65 CAK	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	4.17	1.62	1.58	1.39	°C/W
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	62.5	62.0	62.0	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=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	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 (Note2,3)	--	9.93	--	ns
Turn-on Rise Time	t_r		--	25.6	--	
Turn-off Delay Time	$t_{d(off)}$		--	27.6	--	
Turn-off Fall Time	t_f		--	25.6	--	
Total Gate Charge	Q_g	V_{DD}=520V, V_{GS}=10V, I_D=4A (Note 2,3)	--	12.5	--	nC
Gate-Source Charge	Q_{gs}		--	2.74	--	
Gate-Drain Charge	Q_{gd}		--	6.31	--	

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Continuous Source Current	I_S	Integral Reverse P-N Junction	--	--	4.0	A
Pulsed Source Current	I_{SM}	Diode in the MOSFET	--	--	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,	--	450	--	ns
Reverse Recovery Charge	Q_{rr}	dI_F/dt=100A/μs (Note 2)	--	1.87	--	μC

Notes:

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

TYPICAL CHARACTERISTICS

Figure 1. On-Region Characteristics

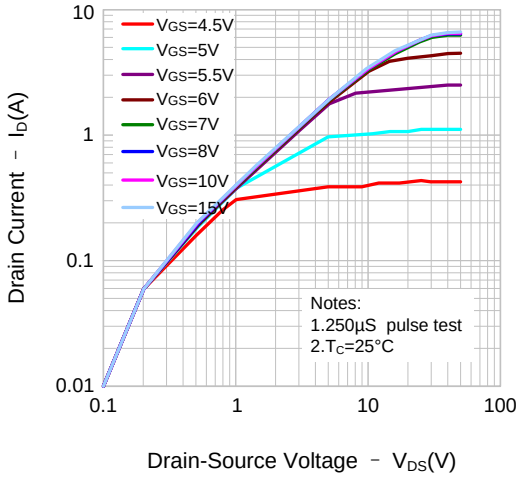


Figure 2. Transfer Characteristics

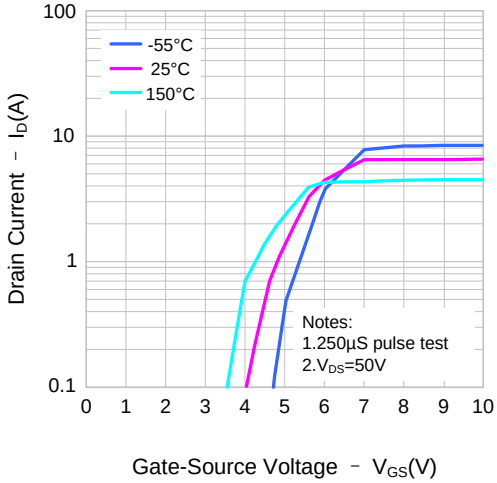


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

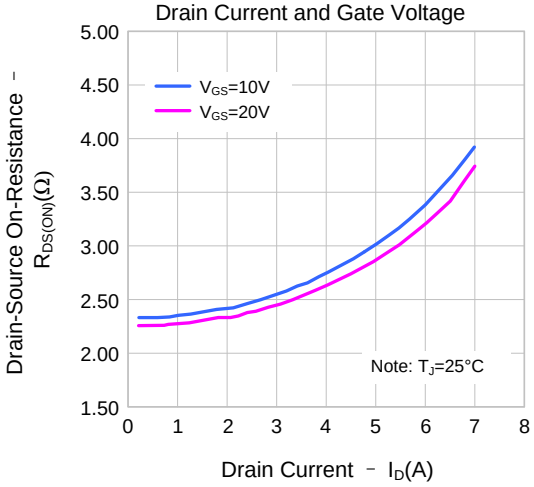


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

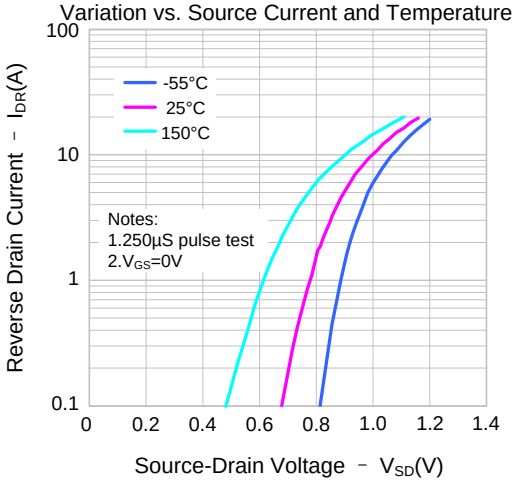


Figure 5. Capacitance Characteristics

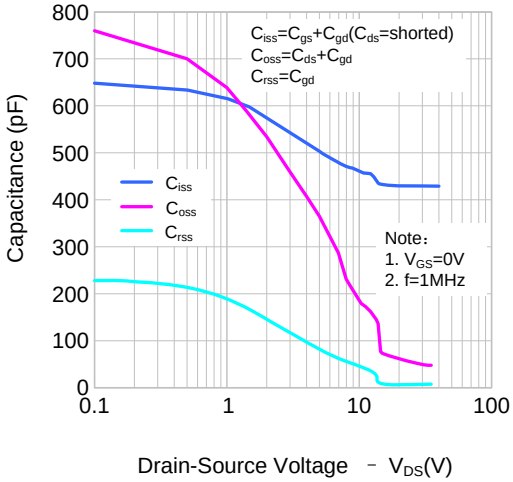
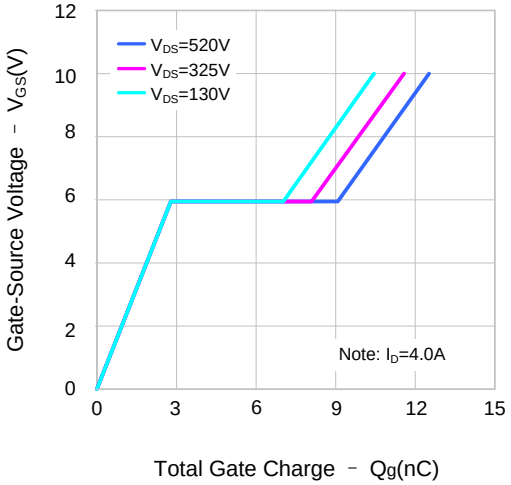


Figure 6. Gate Charge Characteristics



TYPICAL CHARACTERISTICS(continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

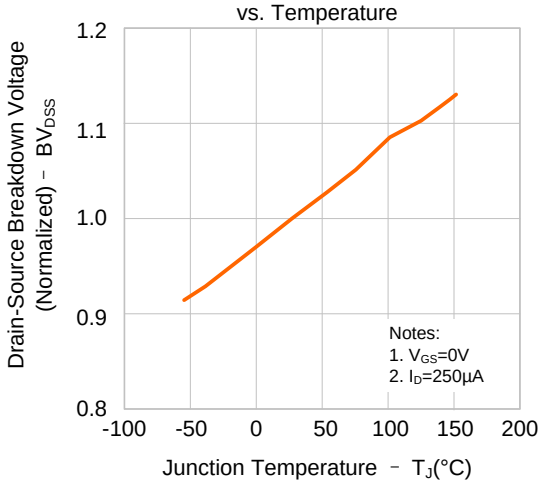


Figure 8. On-resistance vs. Temperature

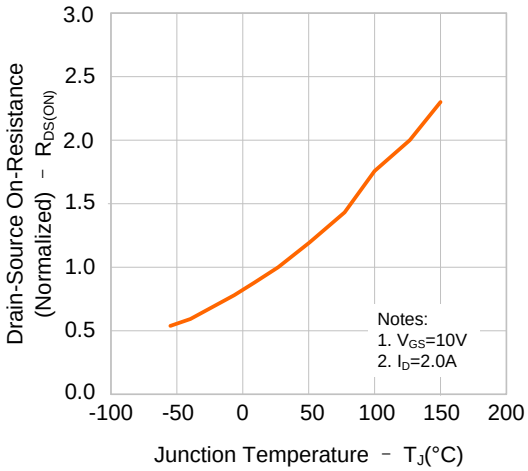


Figure 9-1. Max. Safe Operating Area(SVF4N65CAF)

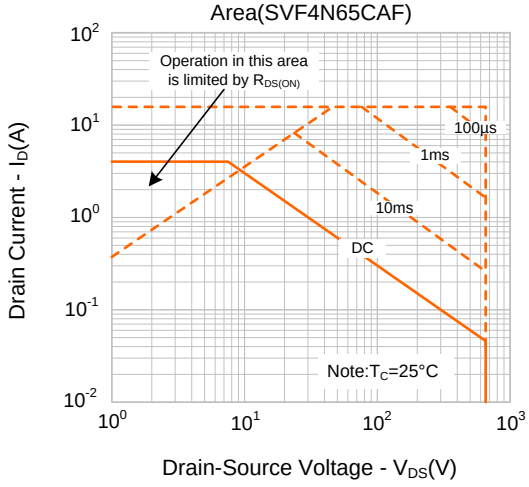


Figure 9-2. Max. Safe Operating Area(SVF4N65CAM/D)

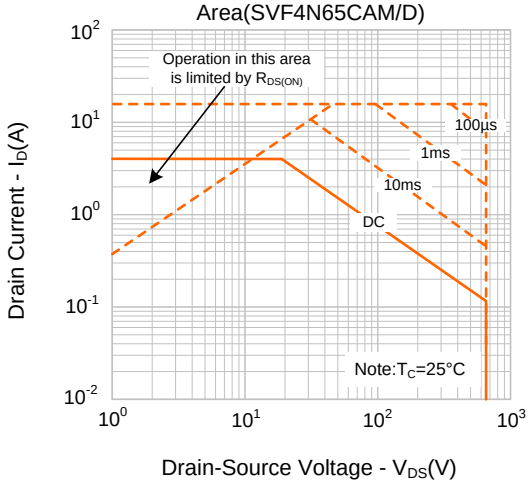


Figure 9-3. Max. Safe Operating Area(SVF4N65CAMJ/MN)

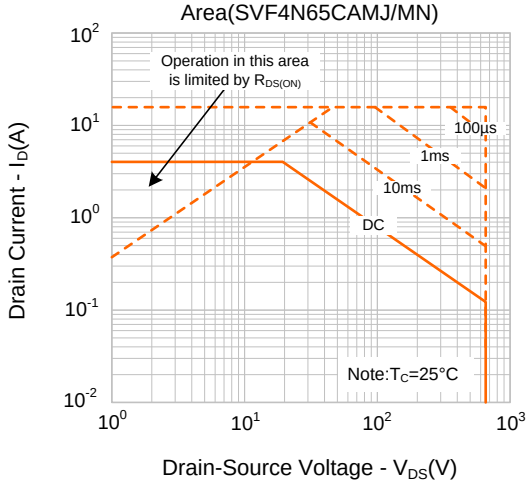
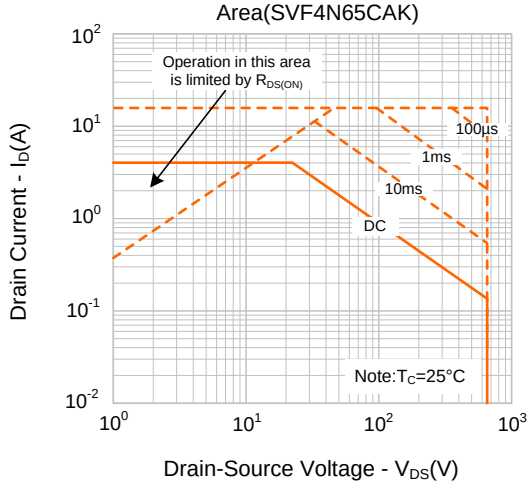
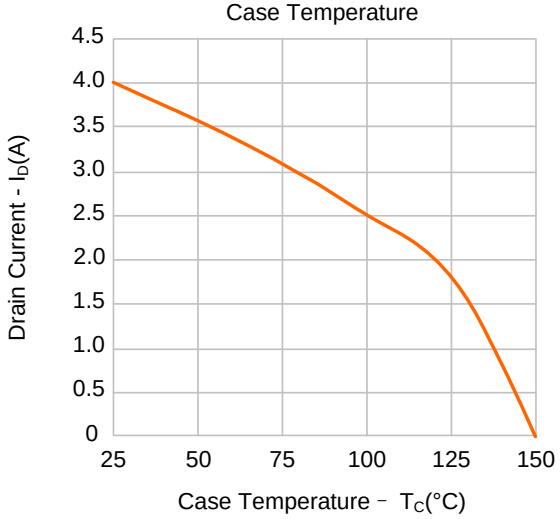


Figure 9-4. Max. Safe Operating Area(SVF4N65CAK)



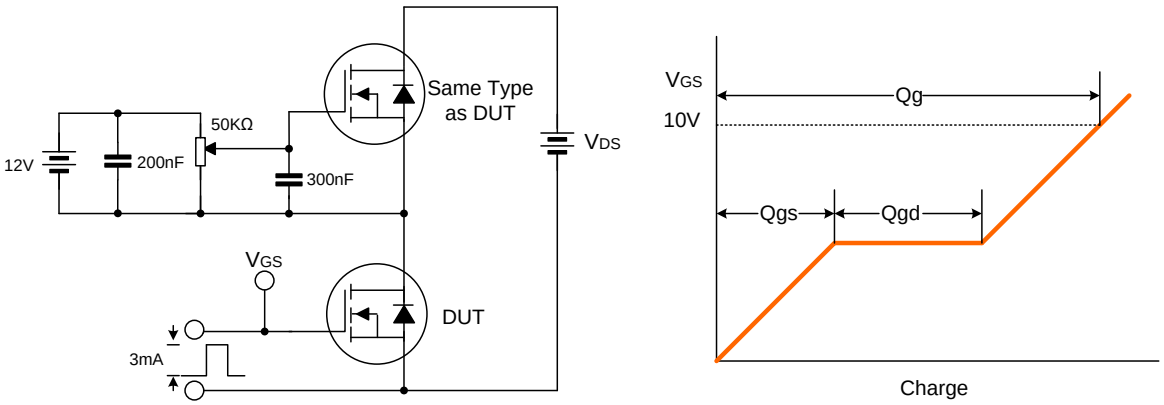
TYPICAL CHARACTERISTICS(continued)

Figure 10. Maximum Drain Current vs. Case Temperature

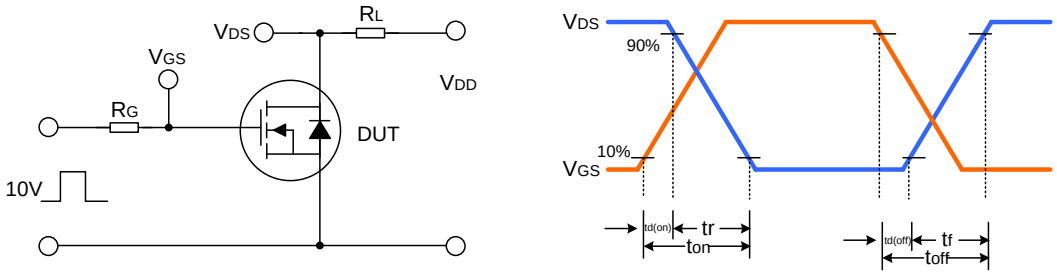


TYPICAL TEST CIRCUIT

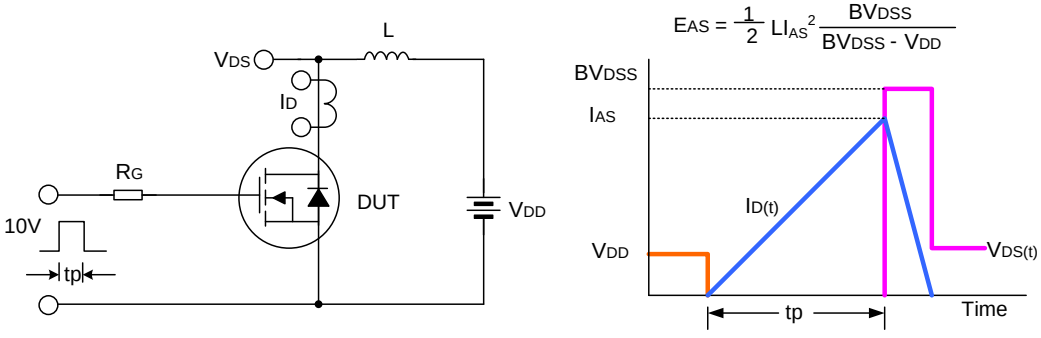
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



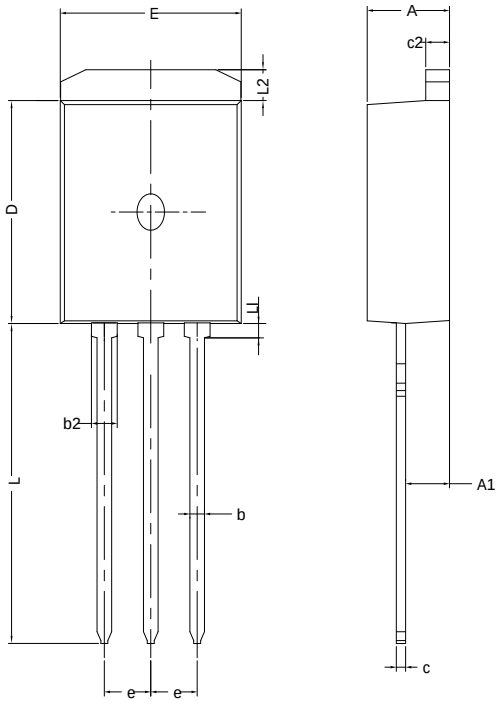
Unclamped Inductive Switching Test Circuit & Waveform



PACKAGE OUTLINE

TO-262-3L

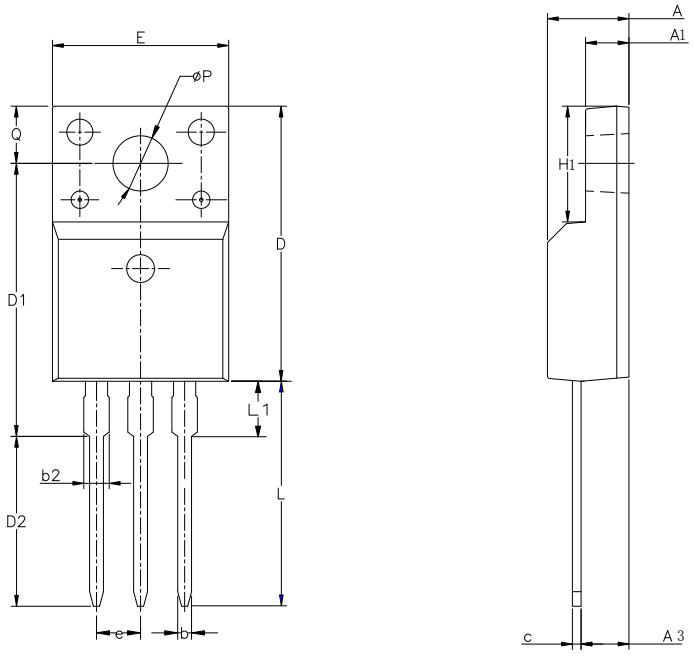
UNIT: mm



SYMBOL	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

TO-220F-3L

UNIT: mm

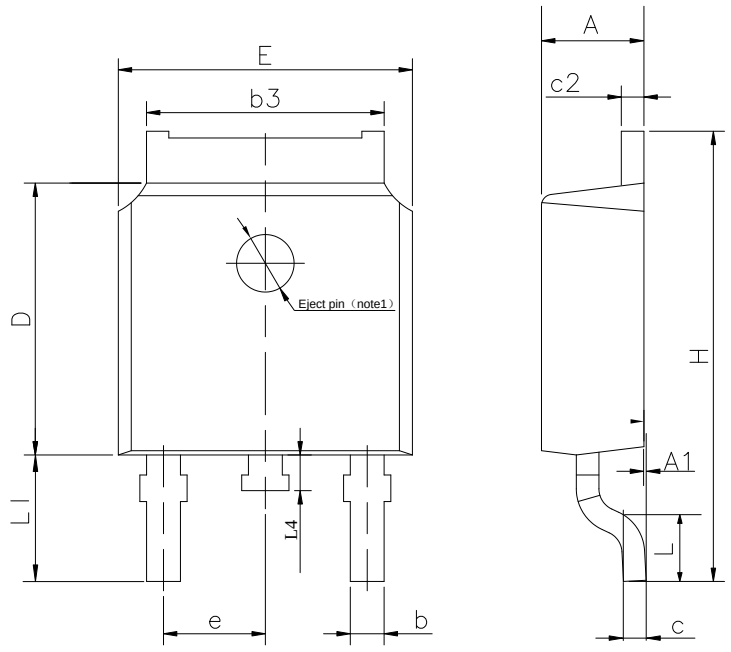


SYMBOL	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.70	0.80	0.90
b2	—	—	1.47
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	15.30	15.75	16.30
D2	9.30	9.80	10.30
E	9.73	10.16	10.36
e	2.54BCS		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	/	/	3.50
ØP	3.00	3.18	3.40
Q	3.05	3.30	3.55

PACKAGE OUTLINE(continued)

TO-252-2L

UNIT: mm

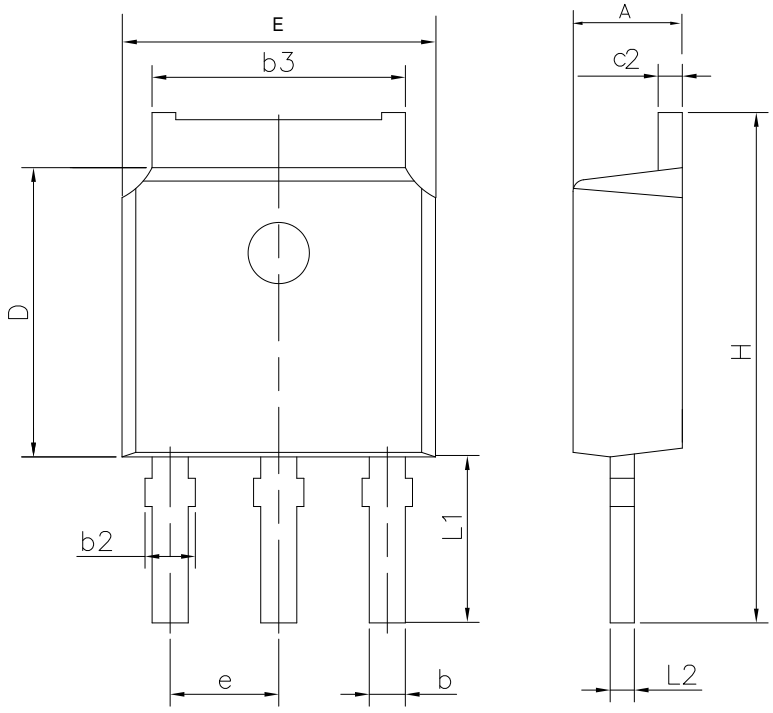


SYMBOL	MIN	NOM	MAX
A	2.10	2.30	2.50
A1	0	---	0.127
b	0.66	0.76	0.89
b3	5.10	5.33	5.46
c	0.45	---	0.65
c2	0.45	---	0.65
D	5.80	6.10	6.40
E	6.30	6.60	6.90
e	2.30TYP		
H	9.60	10.10	10.60
L	1.40	1.50	1.70
L1	2.90REF		
L4	0.60	0.80	1.00

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

TO-251D-3L

UNIT: mm

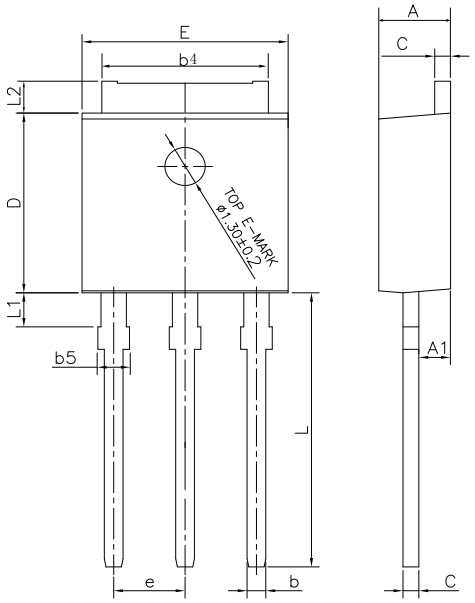


SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.40
b	0.66	---	0.86
b2	0.72	---	0.90
b3	5.10	5.33	5.46
c2	0.46	---	0.60
D	6.00	6.10	6.20
E	6.50	6.60	6.70
e	2.186	2.286	2.386
H	10.40	10.70	11.00
L1	3.50 REF		
L2	0.508 BSC		

PACKAGE OUTLINE(continued)

TO-251J-3L

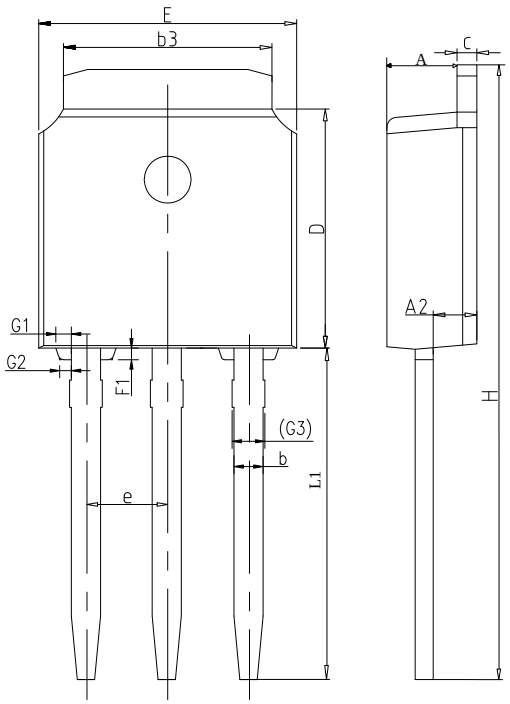
UNIT: mm



SYMBOL	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

TO-251N-3L

UNIT: mm



SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.40
A2	0.97	1.07	1.17
b	0.58	0.68	0.80
b3	5.20	5.33	5.50
c	0.43	0.53	0.63
D	5.80	6.10	6.40
E	6.30	6.60	6.90
e	2.286		
F1	0.20	0.30	0.40
G1	0.30	0.40	0.50
G2	0.20	0.30	0.40
G3	0.60	0.74	0.88
H	16.02	16.52	17.02
L1	9.10	9.40	9.70

Disclaimer :

- **Silan reserves the right to make changes to the information herein for the improvement of the design and performance without prior notice! Customers should obtain the latest relevant information before placing orders and should verify that such information is complete and current.**
- **All semiconductor products malfunction or fail with some probability under special conditions. When using Silan products in system design or complete machine manufacturing, it is the responsibility of the buyer to comply with the safety standards strictly and take essential measures to avoid situations in which a malfunction or failure of such Silan products could cause loss of body injury or damage to property.**
- **Silan will supply the best possible product for customers!**

Part No.:	SVF4N65CAF/D/M/MJ/MN/K	Document Type:	Datasheet
Copyright:	HANGZHOU SILAN MICROELECTRONICS CO.,LTD	Website:	http: //www.silan.com.cn

Rev.: 2.1

Revision History:

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

Rev.: 2.0

Revision History:

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

Rev.: 1.9

Revision History:

1. Delete the package outline of TO-220F-3L(2)
2. Update package outline of TO-251J-3L

Rev.: 1.8

Revision History:

1. Update Crss of Figure 5
2. Update package outline of TO-251N-3L(1.1version)

Rev.: 1.7

Revision History:

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

Rev.: 1.6

Revision History:

1. Modify the Typical Characteristics

Rev.: 1.5

Revision History:

1. Modify the typical characteristics

Rev.: 1.4

Revision History:

1. Modify the package information of TO-220F-3L
2. Modify the package information of TO-252-2L

Rev.: 1.3

Revision History:

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

2. Modify the parameters

Rev.: 1.2

Revision History:

1. Add the package of TO-251N-3L

Rev.: 1.1

Revision History:

1. Modify the ordering information
2. Modify the thermal characteristics

Rev.: 1.0

Revision History:

1. First release