# 2A, 600V N-CHANNEL MOSFET

GENERAL DESCRIPTION

SVF2N60M(MJ)(N)(NF)(F)(T)(D) is an N-channel enhancement mode power MOS field effect transistor which is produced using Silan proprietary F-Cell^{TM} 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 suppliers, DC-DC converters and H-bridge PWM motor drivers.
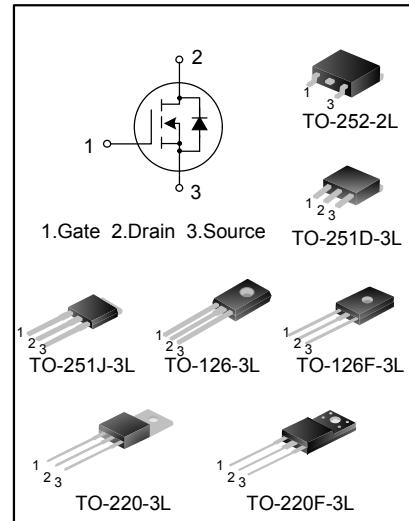
FEATURES

- 2A,600V,$R_{DS(on)(typ.)}$=3.7Ω@V_{GS}=10V
- Low gate charge
- Low Crss
- Fast switching
- Improved dv/dt capability

1.Gate 2.Drain 3.Source

TO-252-2L
TO-251D-3L
TO-251J-3L
TO-126-3L
TO-126F-3L
TO-220-3L
TO-220F-3L

ORDERING INFORMATION

Part No.	Package Type	Marking	Hazardous substance control	Packing
SVF2N60M	TO-251D-3L	SVF2N60M	Halogen free	Tube
SVF2N60MJ	TO-251J-3L	SVF2N60MJ	Halogen free	Tube
SVF2N60N	TO-126-3L	SVF2N60N	Pb free	Tube
SVF2N60N	TO-126-3L	SVF2N60N	Pb free	Bulk
SVF2N60NF	TO-126F-3L	SVF2N60NF	Pb free	Tube
SVF2N60F	TO-220F-3L	SVF2N60F	Pb free	Tube
SVF2N60T	TO-220-3L	SVF2N60T	Pb free	Tube
SVF2N60DTR	TO-252-2L	SVF2N60D	Halogen free	Tape&Reel

ABSOLUTE MAXIMUM RATINGS (T$_C$=25°C unless otherwise noted)

Characteristics		Symbol	Ratings						Unit
			SVF2N 60N	SVF2N 60NF	SVF2N 60M/D	SVF2N 60MJ	SVF2N 60F	SVF2N 60T	
Drain-Source Voltage		V$_{DS}$	600						V
Gate-Source Voltage		V$_{GS}$	±30						V
Drain Current	T$_C$=25°C	I$_D$	2.0						A
	T$_C$=100°C		1.3						
Drain Current Pulsed		I$_{DM}$	8.0						A
Power Dissipation(T$_C$=25°C)		P$_D$	30	16	34	35	23	44	W
Derate above 25°C			0.24	0.13	0.27	0.28	0.18	0.35	W/°C
Single Pulsed Avalanche Energy(Note 1)		E$_{AS}$	115						mJ
Operation Junction Temperature Range		T$_J$	-55～+150						°C
Storage Temperature Range		T$_{stg}$	-55～+150						°C

THERMAL CHARACTERISTICS

Characteristics	Symbol	Ratings						Unit
		SVF2N 60N	SVF2N 60NF	SVF2N 60M/D	SVF2N 60MJ	SVF2N 60F	SVF2N 60T	
Thermal Resistance, Junction-to-Case	R$_{\theta JC}$	4.17	7.81	3.7	3.57	5.56	2.86	°C/W
Thermal Resistance, Junction-to-Ambient	R$_{\theta JA}$	62.5	120	62.0	62.0	62.5	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	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$_D$=1.0A	--	3.7	4.2	Ω
Input Capacitance	C$_{iss}$	V$_{DS}$=25V,V$_{GS}$=0V, f=1.0MHZ	179	233	303	pF
Output Capacitance	C$_{oss}$		--	32	--	
Reverse Transfer Capacitance	C$_{rss}$		--	2.8	--	
Turn-on Delay Time	t$_{d(on)}$	V$_{DD}$=300V,I$_D$=2.0A, R$_G$=25Ω	--	8.9	--	ns
Turn-on Rise Time	t$_r$		--	23.0	--	
Turn-off Delay Time	t$_{d(off)}$	(Note 2,3)	--	23.4	--	

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Turn-off Fall Time	t_f		--	24.9	--	
Total Gate Charge	Q_g	V_{DS}=480V,I_D=2.0A, V_{GS}=10V (Note 2,3)	--	8.24	--	nC
Gate-Source Charge	Q_{gs}		--	1.64	--	
Gate-Drain Charge	Q_{gd}		--	4.44	--	

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	--	--	2.0	A
Pulsed Source Current	I_{SM}		--	--	8.0	
Diode Forward Voltage	V_{SD}	I_S=2.0A,V_{GS}=0V	--	--	1.4	V
Reverse Recovery Time	T_{rr}	I_S=2.0A,V_{GS}=0V, dI_F/dt=100A/µS	--	326	--	ns
Reverse Recovery Charge	Q_{rr}		--	0.87	--	µC

Notes:

1. L=30mH, I_{AS}=2.52A, 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

VGS=4.5V
VGS=5V
VGS=5.5V
VGS=6V
VGS=7V
VGS=8V
VGS=10V
VGS=15V

Drain Current – $I_D(A)$

Drain-Source Voltage – $V_{DS}(V)$

Notes:
1.250μS pulse test
2.T_C=25°C

Figure 2. Transfer Characteristics

-55°C
25°C
150°C

Drain Current – $I_D(A)$

Gate-Source Voltage – $V_{GS}(V)$

Notes:
1.250μS pulse test
2.V_{DS}=50V

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

VGS=10V
VGS=20V

Drain-Source On-Resistance – $R_{DS(ON)}(\Omega)$

Drain Current – $I_D(A)$

Note：T_J=25°C

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

-55°C
25°C
150°C

Reverse Drain Current – $I_{DR}(A)$

Source-Drain Voltage – $V_{SD}(V)$

Notes:
1.250μS pulse test
2.V_{GS}=0V

TYPICAL CHARACTERISTICS(continued)

Figure 5. Capacitance Characteristics

Ciss=Cgs+Cgd(Cds=shorted)
Coss=Cds+Cgd
Crss=Cgd

Ciss
Coss
Crss

Notes:
1. V_{GS}=0V
2. f=1MHz

Capacitance (pF) vs Drain-Source Voltage – V_{DS}(V)
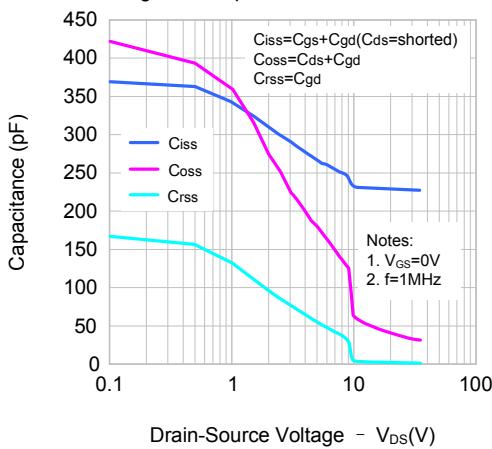
Figure 6. Gate Charge Characteristics

V_{DS}=480V
V_{DS}=300V
V_{DS}=120V

Note: I_D=2.0A

Gate-Source Voltage – V_{GS}(V) vs Total Gate Charge – Qg(nC)
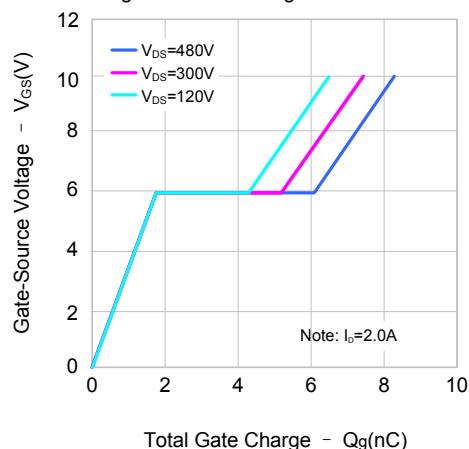
Figure 7. Breakdown Voltage Variation vs. Temperature

Notes:
1. V_{GS}=0V
2. I_D=250μA

Drain-Source Breakdown Voltage (Normalized) – BV_{DSS} vs Junction Temperature – T_J(°C)
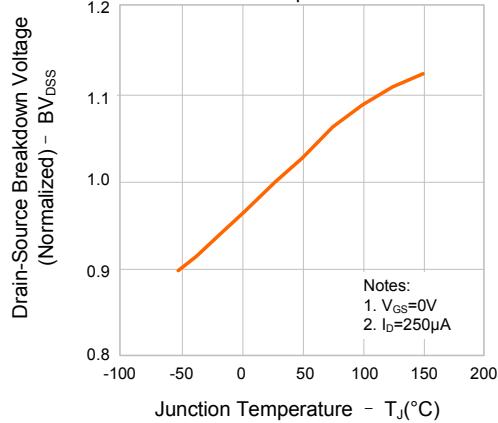
Figure 8. On-resistance vs. Temperature

Notes:
1. V_{GS}=10V
2. I_D=1.0A

Drain-Source On-Resistance (Normalized) – $R_{DS(ON)}$ vs Junction Temperature – T_J(°C)
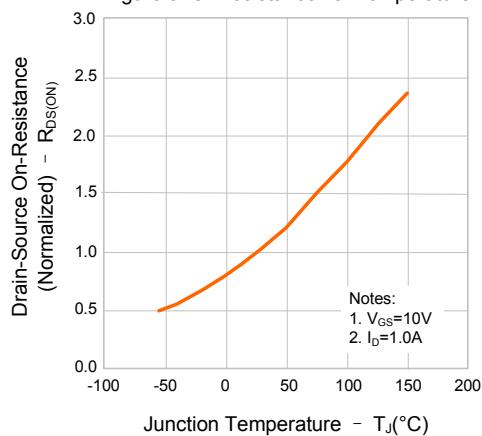
Figure 9-1. Max. Safe Operating Area(SVF2N60N)

Operation in this area is limited by $R_{DS(ON)}$

100μs
1ms
10ms
DC

Notes:
1.T_C=25°C
2.T_J=150°C
3.$R_{DS(ON)}$[max]=4.2Ω

Drain Current - I_D(A) vs Drain-Source Voltage - V_{DS}(V)
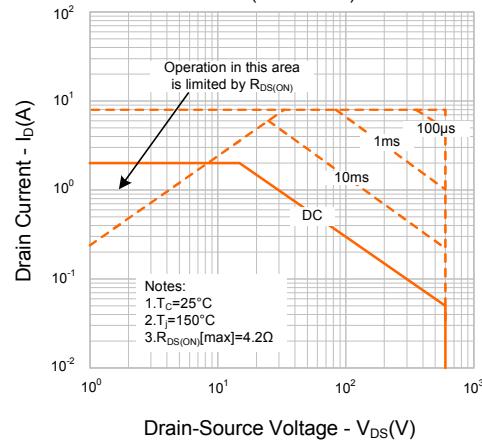
Figure 9-2. Max. Safe Operating Area(SVF2N60NF)

Operation in this area is limited by $R_{DS(ON)}$

100μs
1ms
10ms
DC

Notes:
1.T_C=25°C
2.T_J=150°C
3.$R_{DS(ON)}$[max]=4.2Ω

Drain Current - I_D(A) vs Drain-Source Voltage - V_{DS}(V)
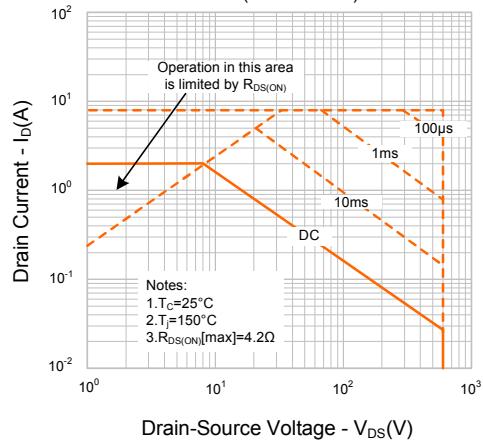
TYPICAL CHARACTERISTICS(continued)

Figure 9-3. Max. Safe Operating
Area(SVF2N60M/D)

Operation in This Area
is Limited by R$_{DS(ON)}$

100μs
1ms
10ms
DC

Notes:
1.T$_C$=25℃
2.T$_j$=150℃
3.R$_{DS(ON)}$[max]=4.2Ω

Drain Current - I$_D$(A)

Drain-Source Voltage - V$_{DS}$(V)
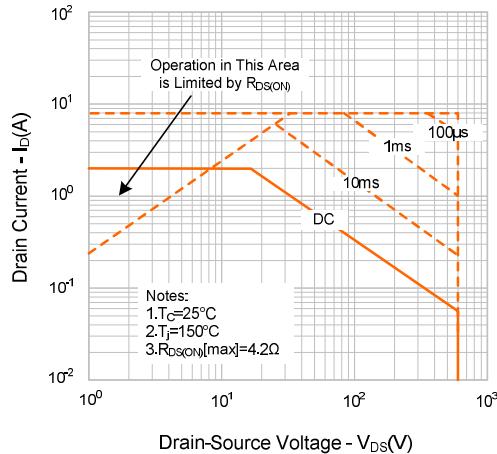
Figure 9-4. Max. Safe Operating
Area(SVF2N60MJ)

Operation in This Area
is Limited by R$_{DS(ON)}$

100μs
1ms
10ms
DC

Notes:
1.T$_C$=25℃
2.T$_j$=150℃
3.R$_{DS(ON)}$[max]=4.2Ω

Drain Current - I$_D$(A)

Drain-Source Voltage - V$_{DS}$(V)
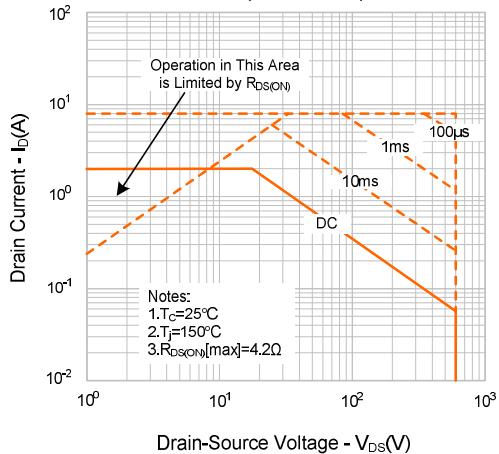
Figure 9-5. Max. Safe Operating
Area(SVF2N60F)

Operation in This Area
is Limited by R$_{DS(ON)}$

100μs
1ms
10ms
DC

Notes:
1.T$_C$=25℃
2.T$_j$=150℃
3.R$_{DS(ON)}$[max]=4.2Ω

Drain Current - I$_D$(A)

Drain-Source Voltage - V$_{DS}$(V)
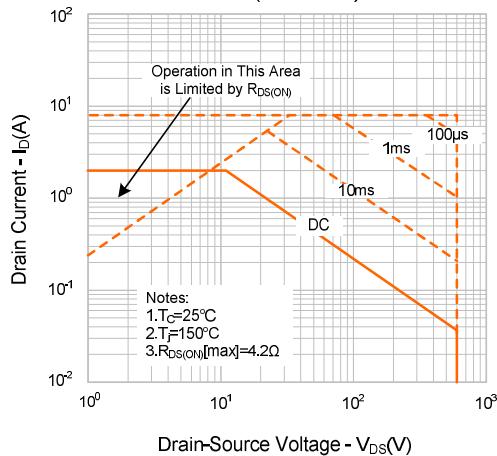
Figure 9-6. Max. Safe Operating
Area(SVF2N60T)

Operation in This Area is
Limited by R$_{DS(ON)}$

100μs
1ms
10ms
DC

Notes:
1.T$_C$=25℃
2.T$_j$=150℃
3.Single Pulse

Drain Current - I$_D$(A)

Drain-Source Voltage - V$_{DS}$(V)
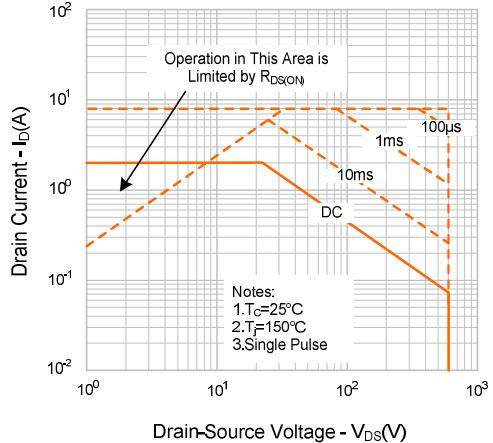
Figure 10. Max. Drain Current vs. Case
Temperature

Drain Current - I$_D$ (A)

Case Temperature - T$_C$ (℃)
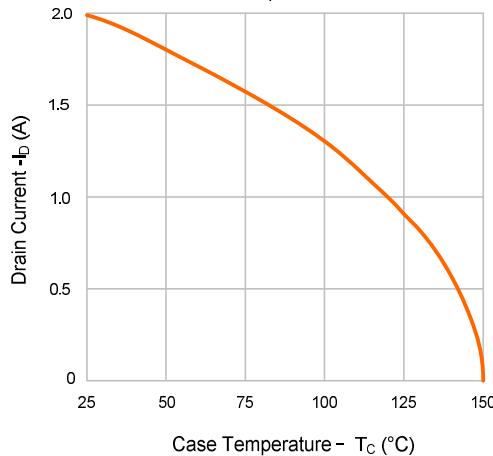
TYPICAL TEST CIRCUIT

Gate Charge Test Circuit & Waveform
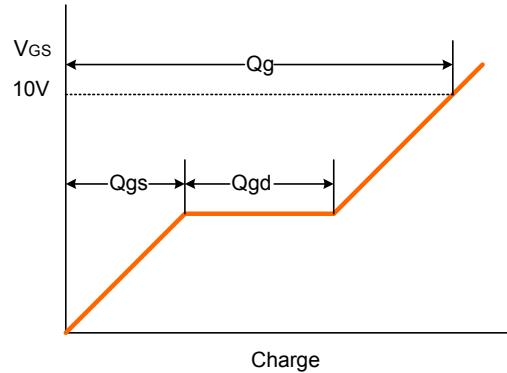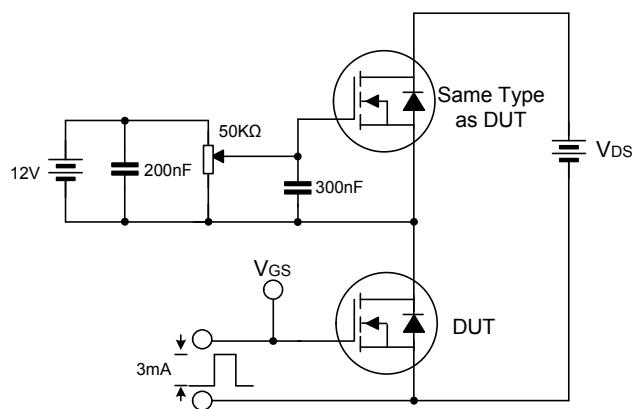
Resistive Switching Test Circuit & Waveform
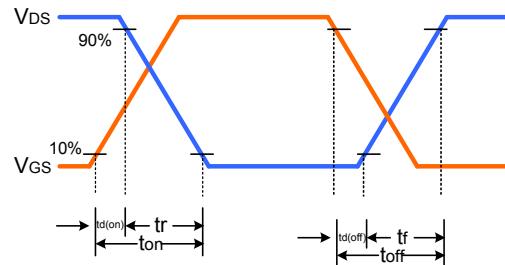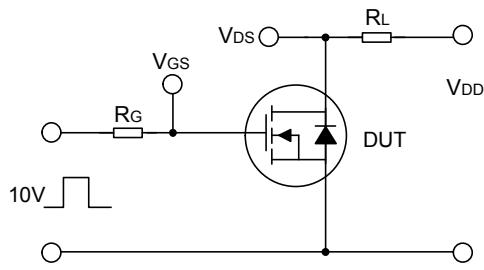
Unclamped Inductive Switching Test Circuit & Waveform

$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$
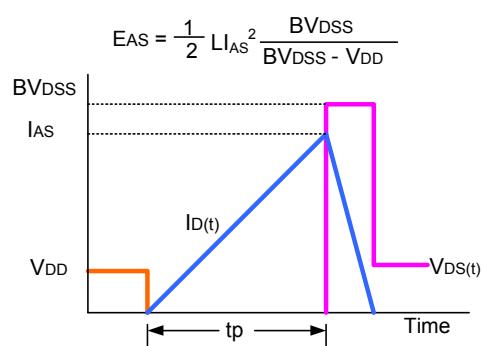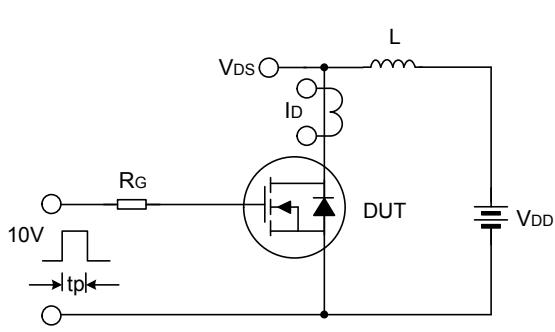
PACKAGE OUTLINE

TO-126F-3L   UNIT: mm
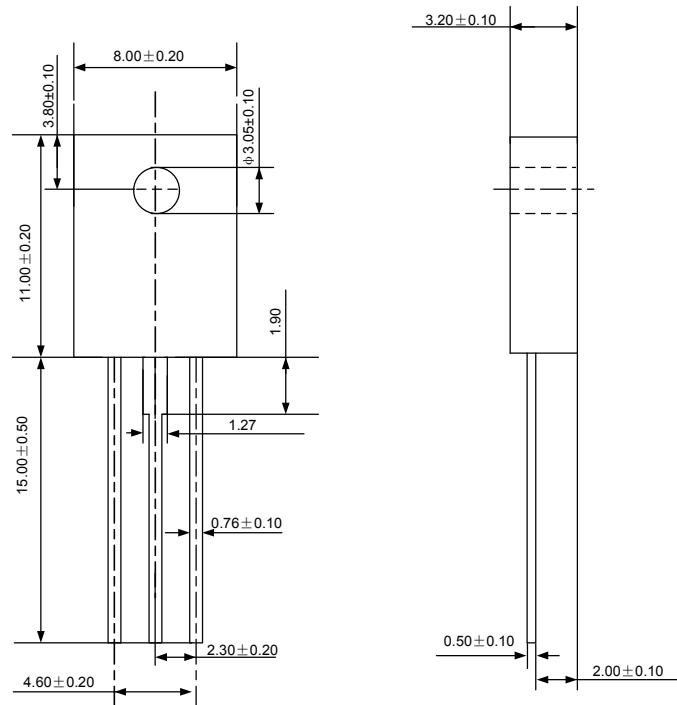
TO-220-3L   UNIT: mm
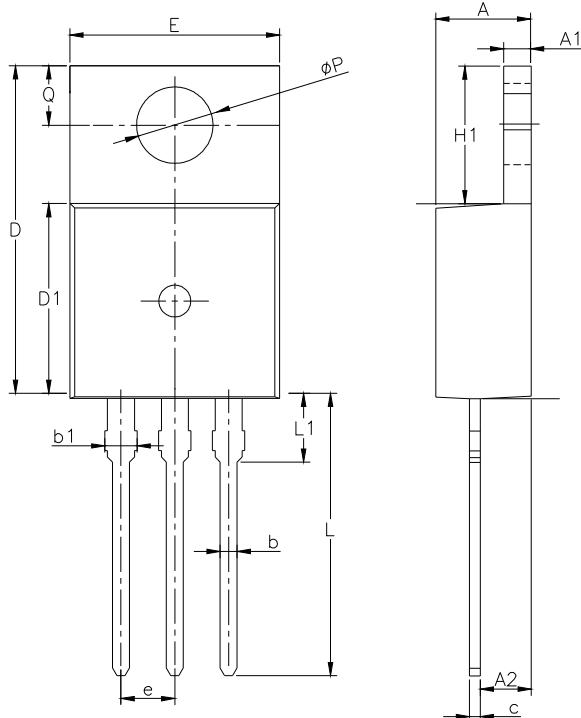
SYMBOL	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	1.00	1.30	1.50
A2	1.80	2.40	2.80
b	0.60	0.80	1.00
b1	1.00	—	1.60
c	0.30	—	0.70
D	15.10	15.70	16.10
D1	8.10	9.20	10.00
E	9.60	9.90	10.40
e		2.54BSC	
H1	6.10	6.50	7.00
L	12.60	13.08	13.60
L1	—	—	3.95
ΦP	3.40	3.70	3.90
Q	2.60	—	3.20

PACKAGE OUTLINE(continued)

TO-251D-3L
UNIT: mm
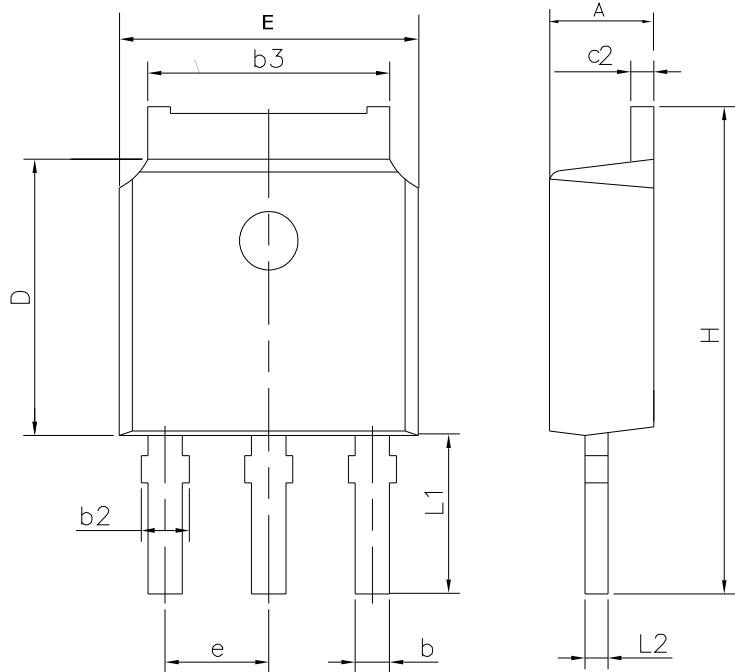
SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.40
b	0.66	---	0.86
b2	0.72	---	0.90
b3	5.10	5.33	5.46
c2	0.46	---	0.60
D	6.00	6.10	6.20
E	6.50	6.60	6.70
e	2.186	2.286	2.386
H	10.40	10.70	11.00
L1	3.50 REF		
L2	0.508 BSC		

TO-251J-3L
UNIT: mmc

6.35~6.73
4.95~5.46
0.89~1.27
5.97~6.22
8.89~9.65
2.29TYP
0.56~0.89
2.18~2.39
0.46~0.89
0.46~0.61
0.89~1.14
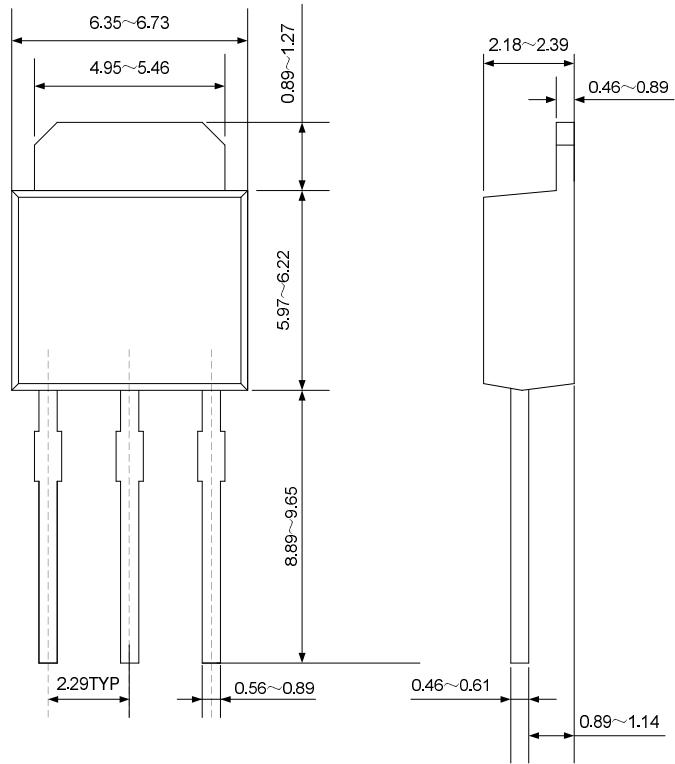
PACKAGE OUTLINE(continued)

TO-252-2L UNIT: mm

NOTE1 : There are two conditions for this position:has an eject pin or has no eject pin.
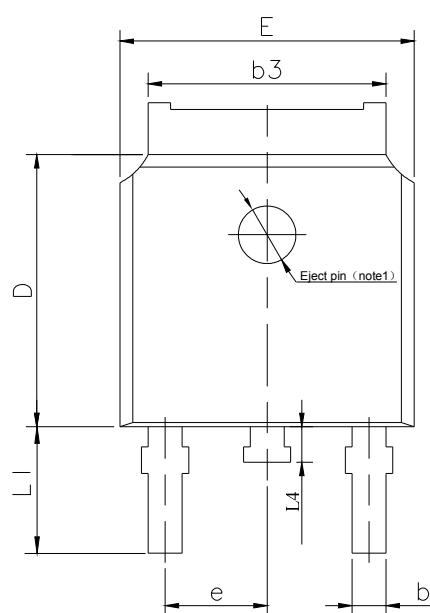
SYMBOL	MIN	NOM	MAX
A	2.10	2.30	2.50
A1	0	---	0.127
b	0.66	0.76	0.89
b3	5.10	5.33	5.46
c	0.45	---	0.65
c2	0.45	---	0.65
D	5.80	6.10	6.40
E	6.30	6.60	6.90
e		2.30TYP	
H	9.60	10.10	10.60
L	1.40	1.50	1.70
L1		2.90REF	
L4	0.60	0.80	1.00

TO-126-3L UNIT: mm
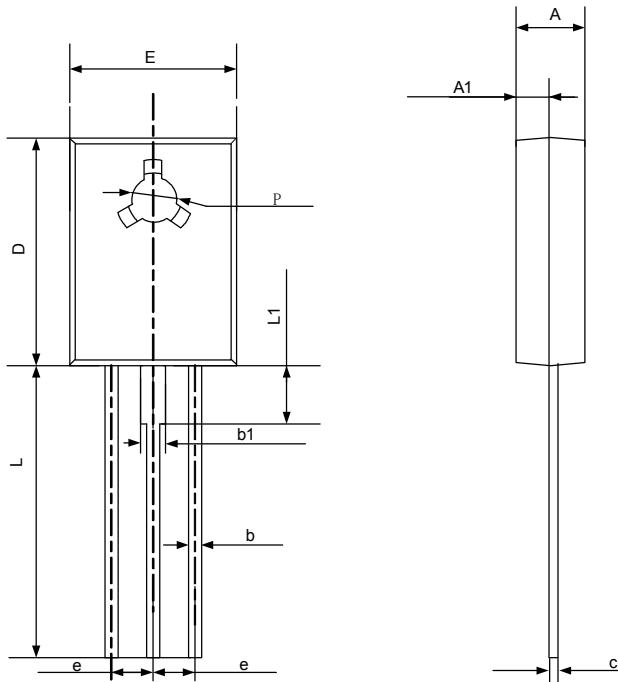
SYMBOL	MIN	NOM	MAX
A	2.48	2.70	2.90
A1	1.00	—	1.50
b	0.66	0.76	0.86
b1	1.17	1.37	1.45
c	0.40	—	0.60
D	10.60	11.00	11.40
E	7.40	—	8.20
e		2.29TYP	
L	14.50		15.80
L1	2.10	—	2.35
P	2.90	3.10	3.30

PACKAGE OUTLINE(continued)

TO-220F-3L(1)	单位：毫米
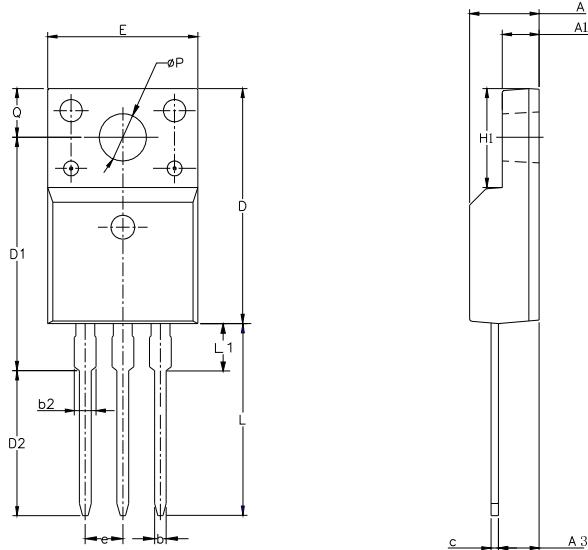
SYMBOL	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.70	0.80	0.90
b2	—	—	1.47
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	15.30	15.75	16.30
D2	9.30	9.80	10.30
E	9.73	10.16	10.36
e	2.54BCS		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	/	/	3.50
øP	3.00	3.18	3.40
Q	3.05	3.30	3.55

TO-220F-3L(2)	单位：毫米
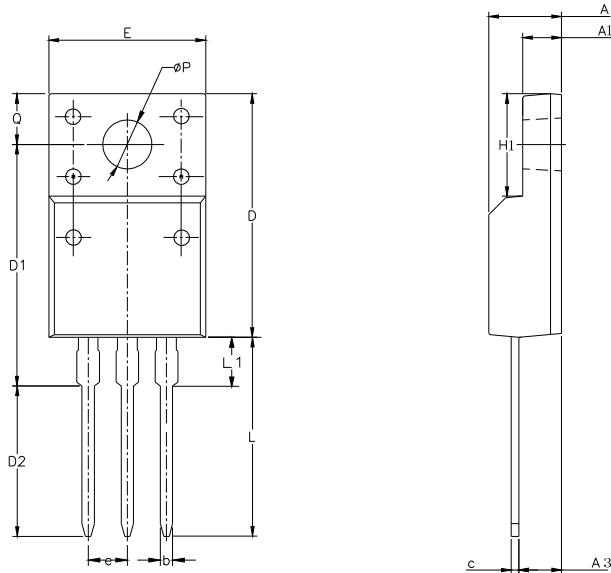
SYMBOL	MIN	NOM	MAX
A	4.20	4.50	4.80
A1	2.40	2.70	3.00
A3	2.30	2.60	2.90
b	0.50	0.65	0.80
c	0.45	0.60	0.75
D	14.50	15.00	15.50
D1	14.90	15.40	15.90
D2	9.10	9.60	10.10
E	9.50	10.00	10.50
e	2.54BCS		
H1	6.60	6.90	7.20
L	12.50	13.00	13.50
L1	2.90	3.40	3.90
øP	2.90	3.20	3.50
Q	2.70	3.00	3.30

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.
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- Silan will supply the best possible product for customers!

Part No.:	SVF2N60M/MJ/N/NF/F/T/D	Document Type:	Datasheet
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Rev.:	3.3	Author:	Yin Zi
Revision History:			
1. Update characteristics			
Rev.:	3.2	Author:	Yin Zi
Revision History:			
1. Modify the Ordering information			
Rev.:	3.1	Author:	Yin Zi
Revision History:			
1. Modify the package outline of TO-126-3L			
2. Modify the package outline of TO-251 D -3L			
Rev.:	3.0	Author:	Yin Zi
Revision History:			
1. Modify the package information of TO-220-3L			
Rev.:	2.9	Author:	Yin Zi
Revision History:			
1. Modify the package of TO-220F-3L;Modify the package of TO-252-2L;			
Rev.:	2.8	Author:	Yin Zi
Revision History:			
1. Modify the thermal characteristics			
Rev.:	2.7	Author:	Yin Zi
Revision History:			
1. Modify the note 1			
Rev.:	2.6	Author:	Yin Zi
Revision History:			
1. Add the pin No.			
Rev.:	2.5	Author:	Yin Zi
Revision History:			
1. Modify the package outline of TO-251J-3L			
Rev.:	2.4	Author:	Yin Zi
Revision History:			
1. Modify the ordering information			

Rev.:	2.3		Author:	Yin Zi

Revision History:

1. Modify the package outline of TO-126-3L

Part No.:	SVF2N60M/MJ/N/NF/F/T/D	Document Type:	Datasheet
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1. Change the schematic diagram of MOS

Rev.:	2.1		Author:	Yin Zi

Revision History:

1. Modify the package outline of TO-251D-3L; Add the value of forward transconductance

Rev.:	2.0		Author:	Yin Zi

Revision History:

1. Add the halogen free information of SVF2N60M

Rev.:	1.9		Author:	Yin Zi

Revision History:

1. Modify "PACKAGE OUTLINE"

Rev.:	1.8		Author:	Yin Zi

Revision History:

1. Add the package of TO-126-3L(2)

Rev.:	1.7		Author:	Yin Zi

Revision History:

1. Add the package of TO-126F-3L

Rev.:	1.6		Author:	Yin Zi

Revision History:

1. Modify the values of T_{rr} and $Q_{rr;}$ Update the package outline of TO-251D-3L

Rev.:	1.5		Author:	Yin Zi

Revision History:

1. Add the halogen free information of SVF2N60F

Rev.:	1.4		Author:	Yin Zi

Revision History:

1. Delete the package of TO-251-3L

Rev.:	1.3		Author:	Yin Zi

Revision History:

1. Modify "PACKAGE OUTLINE"

Rev.:	1.2		Author:	Yin Zi

Revision History:

1. Add the package of TO-251D-3L, TO-251J-3L, TO-126-3L

Rev.:	1.1	20101021	Author:	Yin Zi

Revision History:

1. Modify "TYPICAL CHARACTERISTICS", "PACKAGE OUTLINE", the template of Datasheet

Rev.:	1.0		Author:	Yin Zi

Revision History:

1.   Original