

## 12A, 650V N-CHANNEL MOSFET

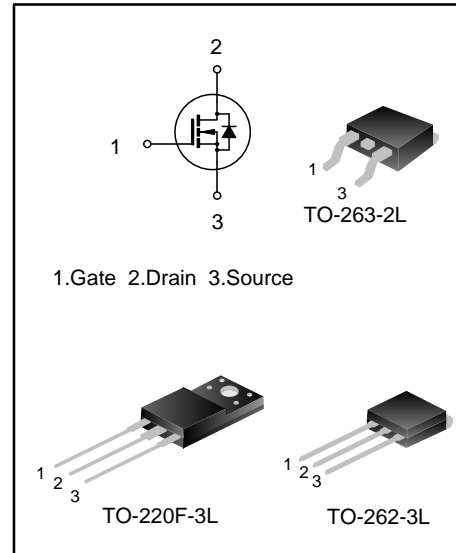
### GENERAL DESCRIPTION

SVF12N65F/K/S 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

- ◆ 12A,650V, $R_{DS(on)(typ.)}=0.64\Omega@V_{GS}=10V$
- ◆ Low gate charge
- ◆ Low  $C_{rss}$
- ◆ Fast switching
- ◆ Improved  $dv/dt$  capability



### ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing Type
SVF12N65F	TO-220F-3L	SVF12N65F	Pb free	Tube
SVF12N65K	TO-262-3L	SVF12N65K	Pb free	Tube
SVF12N65S	TO-263-2L	SVF12N65S	Halogen free	Tube
SVF12N65STR	TO-263-2L	SVF12N65S	Halogen free	Tape &Reel

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

Characteristics	Symbol	Ratings			Unit
		SVF12N65F	SVF12N65K	SVF12N65S	
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>	48			A
Power Dissipation(T <sub>C</sub> =25°C) -Derate above 25°C	P <sub>D</sub>	51	209	210	W
		0.41	1.67	1.68	W/°C
Single Pulsed Avalanche Energy (Note 1)	E <sub>AS</sub>	790			mJ
Reverse Diode dv/dt (Note 2)	dv/dt	4.5			V/ns
MOSFET dv/dt Ruggedness (Note 3)	dv/dt	50			V/ns
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	Ratings			Unit
		SVF12N65F	SVF12N65K	SVF12N65S	
Thermal Resistance, Junction-to-Case	R <sub>θJC</sub>	2.44	0.6	0.60	°C/W
Thermal Resistance, Junction-to-Ambient	R <sub>θJA</sub>	62.5	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> =6.0A	--	0.64	0.8	Ω
Input Capacitance	R <sub>g</sub>	f=1.0MHz	--	5.0	--	Ω
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz	--	1390	--	pF
Output Capacitance	C <sub>oss</sub>		--	156	--	
Reverse Transfer Capacitance	C <sub>rss</sub>		--	15	--	
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =325V, I <sub>D</sub> =12A, V <sub>GS</sub> =10V, R <sub>G</sub> =24Ω  (Note 4,5)	--	26	--	ns
Turn-on Rise Time	t <sub>r</sub>		--	46	--	
Turn-off Delay Time	t <sub>d(off)</sub>		--	82	--	
Turn-off Fall Time	t <sub>f</sub>		--	42	--	
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =520V, I <sub>D</sub> =12A, V <sub>GS</sub> =10V  (Note 4,5)	--	33	--	nC
Gate-Source Charge	Q <sub>gs</sub>		--	7.4	--	
Gate-Drain Charge	Q <sub>gd</sub>		--	14	--	

## 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	--	--	12	A
Pulsed Source Current	I <sub>SM</sub>		--	--	48	
Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> =12A, V <sub>GS</sub> =0V	--	--	1.4	V
Reverse Recovery Time	T <sub>rr</sub>	I <sub>S</sub> =12A, V <sub>GS</sub> =0V, dI <sub>F</sub> /dt=100A/μs  (Note 4)	--	562	--	ns
Reverse Recovery Charge	Q <sub>rr</sub>		--	5.1	--	μC

**Notes:**

1. L=30mH, I<sub>AS</sub>=6.0A, V<sub>DD</sub>=100V, R<sub>G</sub>=25Ω, starting temperature T<sub>J</sub>=25°C;
2. V<sub>DS</sub>=0~400V, I<sub>SD</sub>≤12A, T<sub>J</sub>=25°C;
3. V<sub>DS</sub>=0~480V;
4. Pulse Test: Pulse width ≤300μs, Duty cycle≤2%;
5. Essentially independent of operating temperature.

**TYPICAL CHARACTERISTICS**

Figure 1. On-Region Characteristics

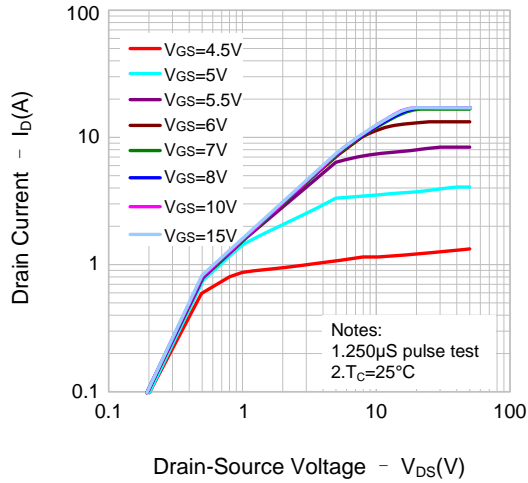


Figure 2. Transfer Characteristics

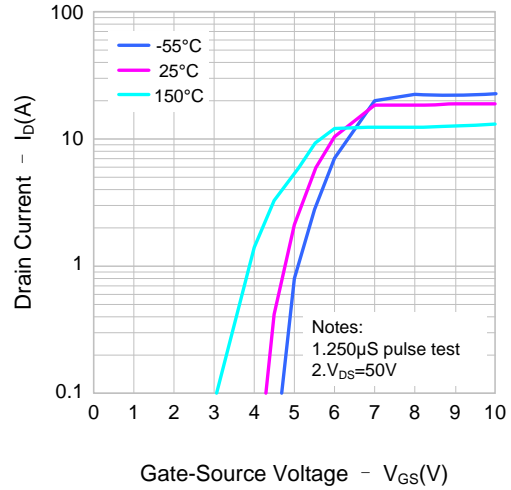


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

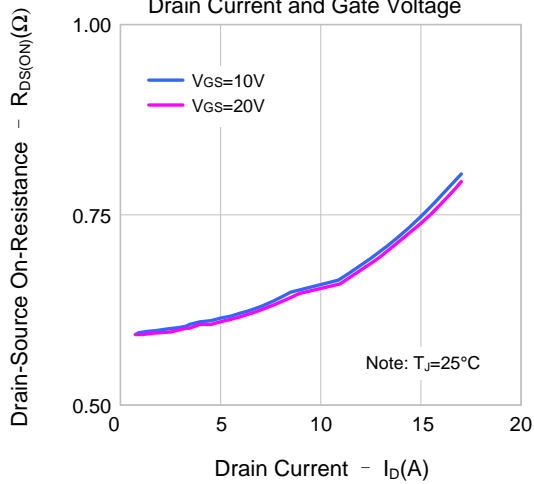


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

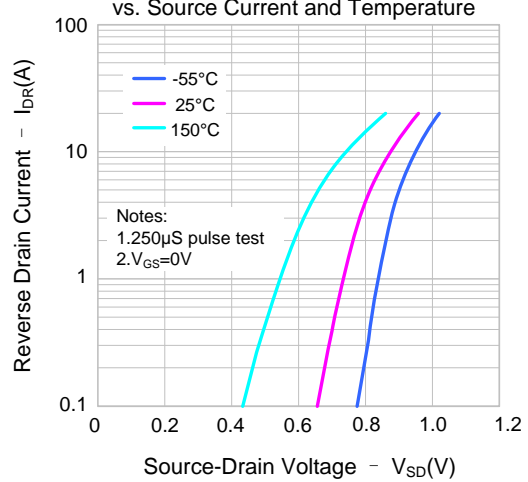


Figure 5. Capacitance Characteristics

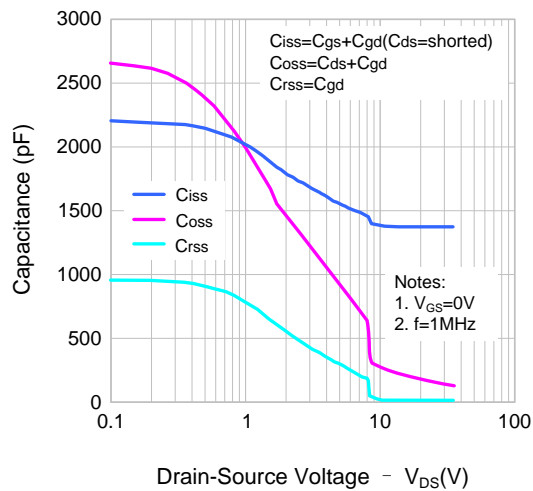
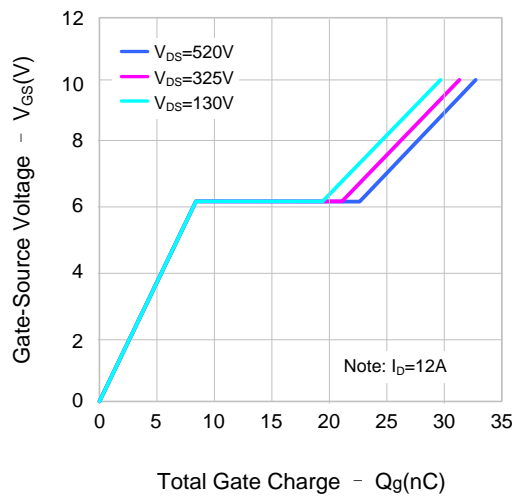


Figure 6. Gate Charge Characteristics



**TYPICAL CHARACTERISTICS (continued)**

Figure 7. Breakdown Voltage Variation vs. Temperature

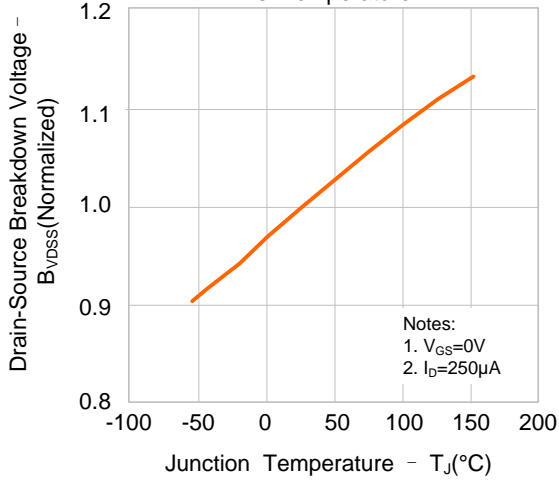


Figure 8. On-resistance vs. Temperature

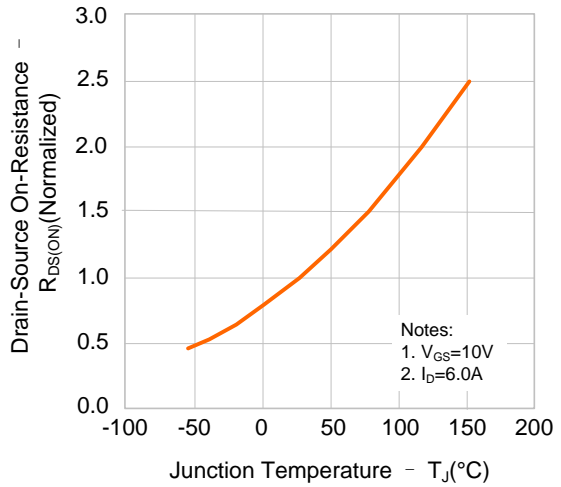


Figure 9-1. Max. Safe Operating Area(SVF12N65F)

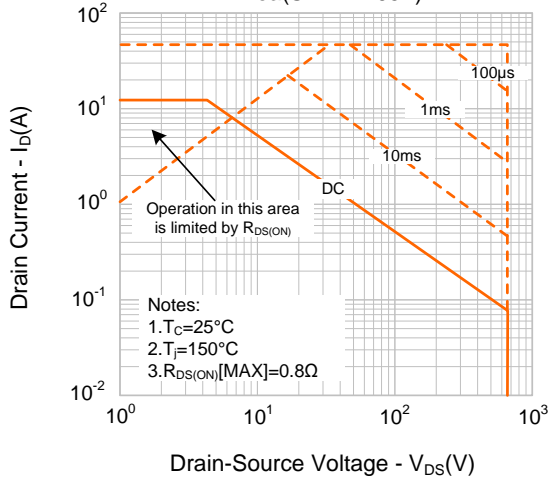


Figure 9-2. Max. Safe Operating Area(SVF12N65K)

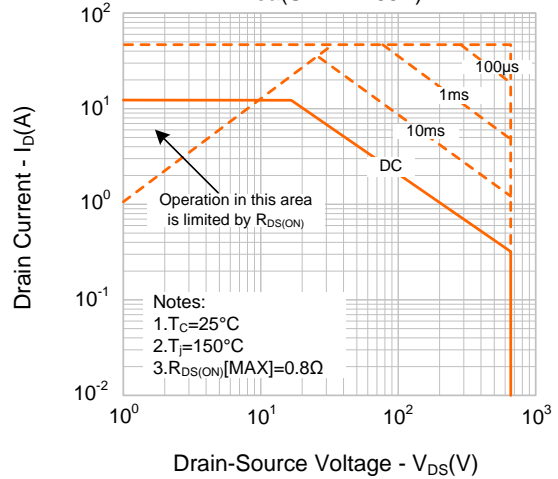


Figure 9-3. Max. Safe Operating Area(SVF12N65S)

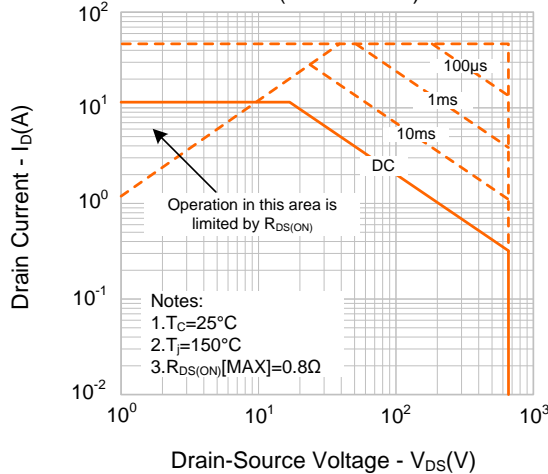
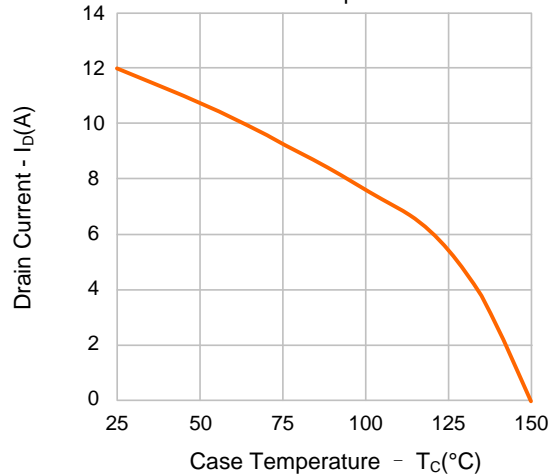
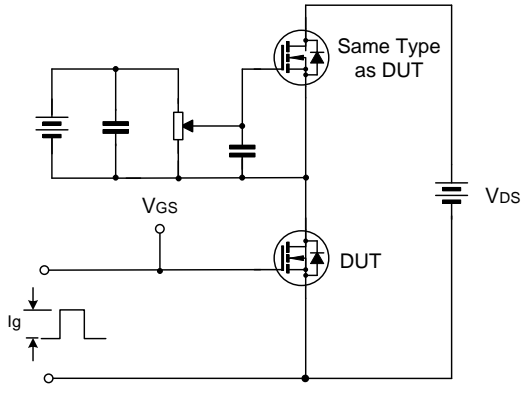


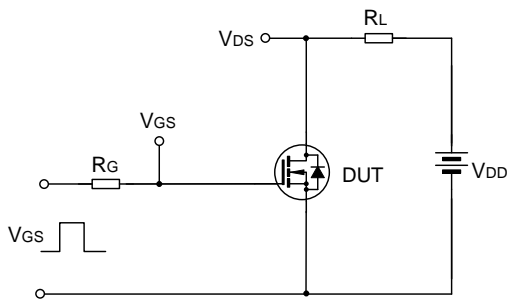
Figure 10. Max. Drain Current vs. Case Temperature



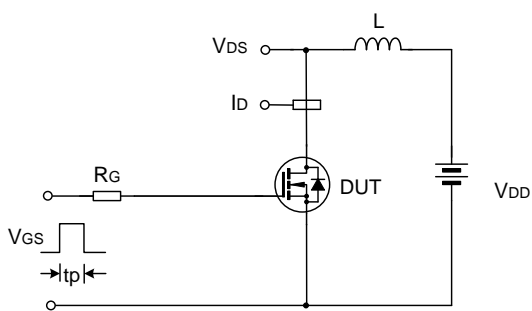
**TYPICAL TEST CIRCUIT**



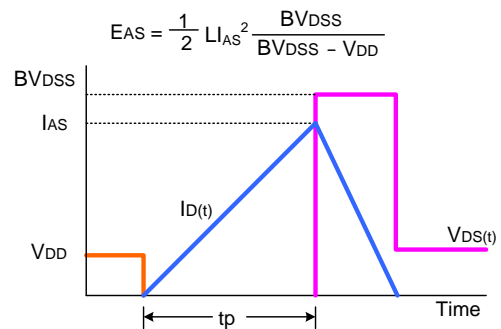
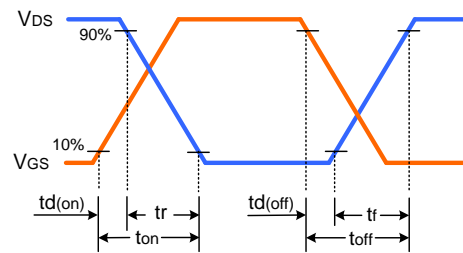
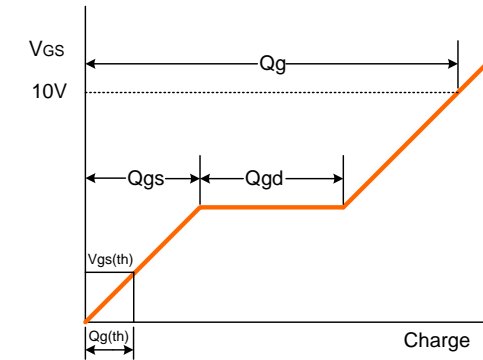
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



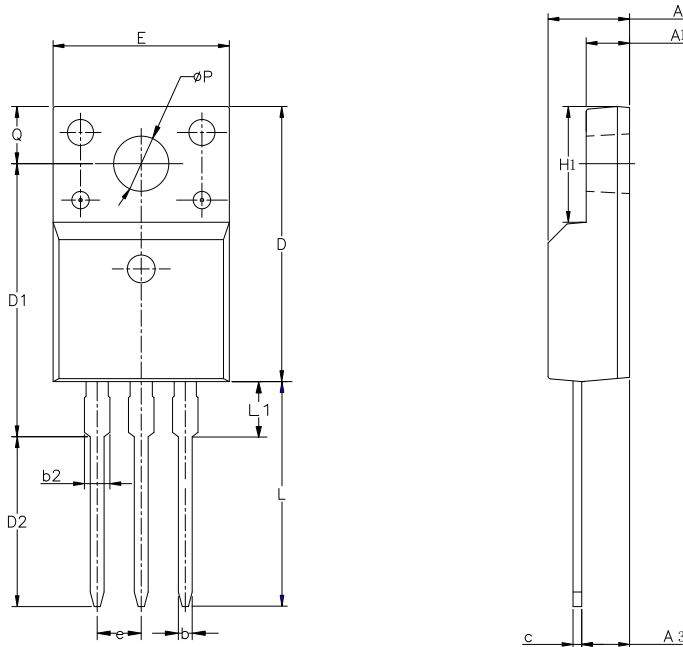
Unclamped Inductive Switching Test Circuit & Waveform



**PACKAGE OUTLINE**

**TO-220F-3L**

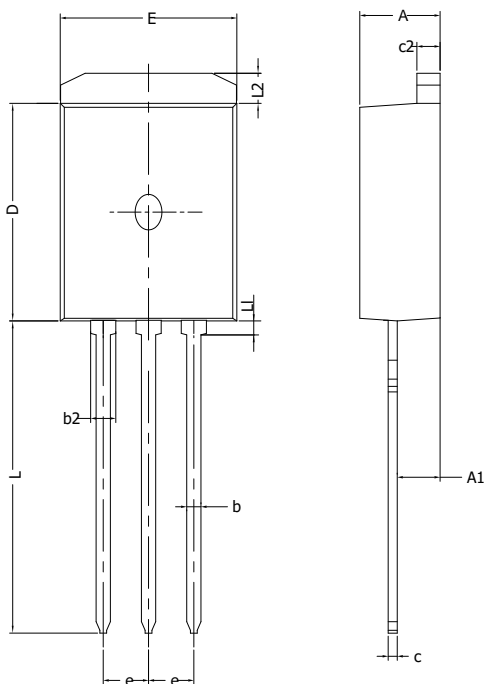
**UNIT: mm**



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
$\phi P$	3.00	3.18	3.40
Q	3.05	3.30	3.55

**TO-262-3L**

**UNIT: mm**

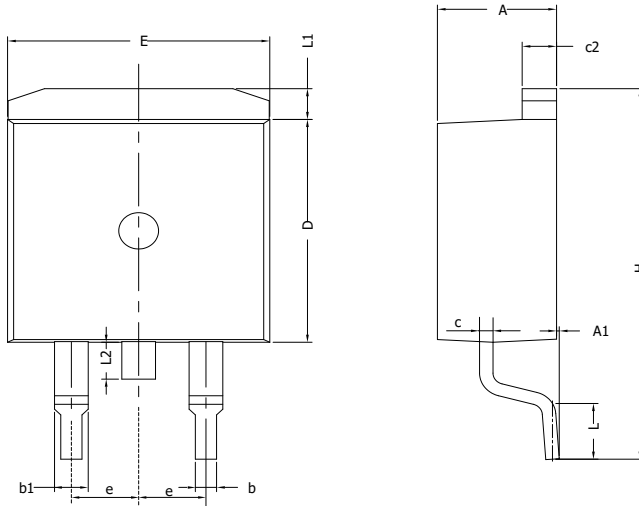


SYMBOL	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	2.20	---	2.92
b	0.71	0.80	0.90
b2	1.20	---	1.50
c	0.34	---	0.65
c2	1.22	1.30	1.35
D	8.38	---	9.30
E	9.80	10.16	10.54
e	2.54 BSC		
L	12.80	---	14.10
L1	---	---	0.75
L2	1.12	---	1.42

**PACKAGE OUTLINE(continued)**

TO-263-2L

UNIT: mm



SYMBOL	MIN	NOM	MAX
A	4.30	4.57	4.72
A1	0	0.10	0.25
b	0.71	0.81	0.91
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

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Rev.: 3.0

Revision History:

1. Update the package outline of TO-262-3L
  2. Update Electrical schematic and typical test circuit
- 

Rev.: 2.9

Revision History:

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

Rev.: 2.8

Revision History:

1. Modify the Electrical characteristics
- 

Rev.: 2.7

Revision History:

1. Revise the hazardous substance control of TO-262-3L from halogen free to Pb free
- 

Rev.: 2.6

Revision History:

1. Add the ordering information
- 

Rev.: 2.5

Revision History:

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

Rev.: 2.4

Revision History:

1. Modify the thermal characteristics
- 

Rev.: 2.3

Revision History:

1. Modify the ordering information
- 

Rev.: 2.2

Revision History:

1. Add the pin No.
- 

Rev.: 2.1

Revision History:

1. Modify the ordering information
  1. Change the schematic diagram of MOS
- 

Rev.: 1.9

Revision History:

1. Modify "PACKAGE OUTLINE"
- 

Rev.: 1.8

Revision History:

1. Modify "TYPICAL CHARACTERISTICS (continued)"
-

Rev.: 1.7

Revision History:

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

Rev.: 1.6

Revision History:

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

Rev.: 1.5

Revision History:

1. Modify the typ. Value of  $R_{DS(on)}$
  1. Modify the values of  $T_{rr}$  and  $Q_{rr}$
- 

Rev.: 1.3

Revision History:

1. Add the halogen free information of SVF12N65F
- 

Rev.: 1.2

Revision History:

1. Modify "ELECTRICAL CHARACTERISTICS" and the capacitance characteristic curve
- 

Rev.: 1.1

Revision History:

1. Modify "PACKAGE OUTLINE"
  1. Original
-