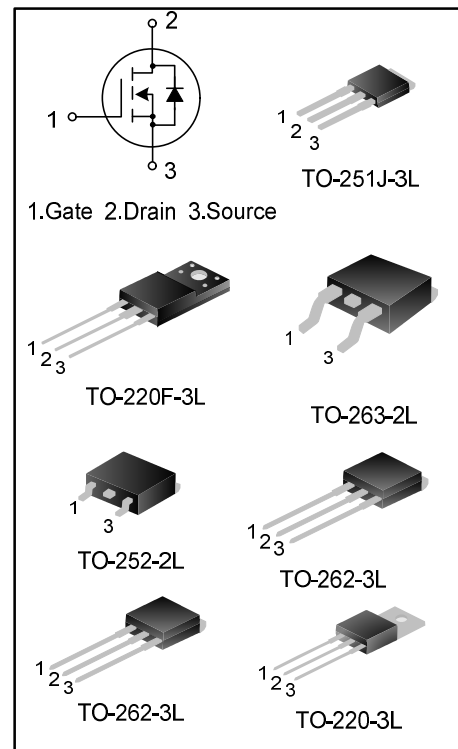# 7A, 600V N-CHANNEL MOSFET

GENERAL DESCRIPTION

SVF7N60CF/S/K/MJ/D/T is an N-channel enhancement mode power MOS field effect transistor which is produced using Silan proprietary F-Cell^{TM} 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.
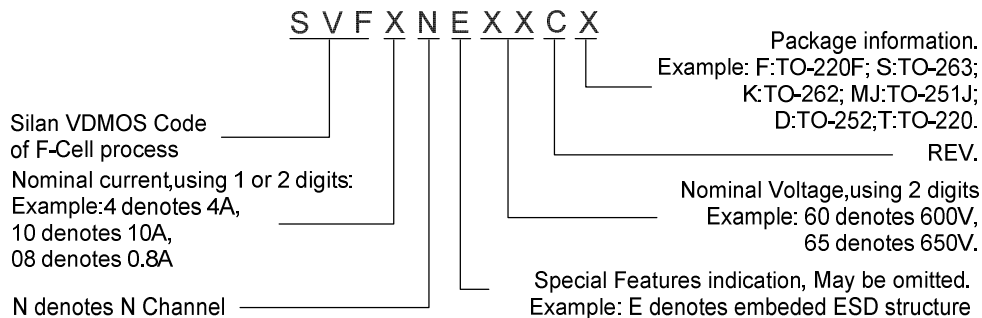
These devices are widely used in AC-DC power supplies, DC-DC converters and H-bridge PWM motor drivers.

FEATURES

- 7A, 600V, $R_{DS(on)（typ）}$ =0.96Ω@V_{GS}=10V
- Low gate charge
- Low Crss
- Fast switching
- Improved dv/dt capability

1.Gate 2.Drain 3.Source

TO-251J-3L
TO-220F-3L
TO-263-2L
TO-252-2L
TO-262-3L
TO-262-3L
TO-220-3L

NOMENCLATURE

S V F X N E X X C X

Silan VDMOS Code of F-Cell process

Nominal current,using 1 or 2 digits:
Example:4 denotes 4A,
10 denotes 10A,
08 denotes 0.8A

N denotes N Channel

Special Features indication, May be omitted.
Example: E denotes embedded ESD structure

Nominal Voltage,using 2 digits
Example: 60 denotes 600V,
65 denotes 650V.

REV.

Package information.
Example: F:TO-220F; S:TO-263;
K:TO-262; MJ:TO-251J;
D:TO-252;T:TO-220.

ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing
SVF7N60CF	TO-220F-3L	SVF7N60CF	Halogen free	Tube
SVF7N60CS	TO-263-2L	SVF7N60CS	Halogen free	Tube
SVF7N60CSTR	TO-263-2L	SVF7N60CS	Halogen free	Tape & Reel
SVF7N60CK	TO-262-3L	SVF7N60CK	Halogen free	Tube
SVF7N60CMJ	TO-251J-3L	SVF7N60C	Halogen free	Tube
SVF7N60CD	TO-252-2L	SVF7N60C	Halogen free	Tube
SVF7N60CDTR	TO-252-2L	SVF7N60C	Halogen free	Tape & Reel
SVF7N60CT	TO-220-3L	SVF7N60CT	Pb free	Tube

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

Characteristics		Symbol	Ratings					Unit
			SVF7N60CF	SVF7N60CS/K	SVF7N60CMJ	SVF7N60CD	SVF7N60CT	
Drain-Source Voltage		V_{DS}	600					V
Gate-Source Voltage		V_{GS}	±30					V
Drain Current	T_C=25°C	I_D	7.0					A
	T_C=100°C		4.0					
Drain Current Pulsed		I_{DM}	28					A
Power Dissipation(T_C=25°C)		P_D	45	122	93	90	145	W
-Derate above 25°C			0.36	0.98	0.74	0.72	1.16	W/°C
Single Pulsed Avalanche Energy(Note 1)		E_{AS}	490					mJ
Operation Junction Temperature Range		T_J	-55～+150					°C
Storage Temperature Range		T_{stg}	-55～+150					°C

THERMAL CHARACTERISTICS

Characteristics	Symbol	Ratings					Unit
		SVF7N60CF	SVF7N60CS/K	SVF7N60CMJ	SVF7N60CD	SVF7N60CT	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	2.78	1.02	1.34	1.39	0.86	°C/W
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	62.5	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	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=3.5A	--	0.96	1.2	Ω
Input Capacitance	C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1.0MHZ	592	770	1001	pF
Output Capacitance	C_{oss}		--	96	--	
Reverse Transfer Capacitance	C_{rss}		--	8.7	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=300V, I_D=7.0A, R_G=25Ω	--	15.5	--	ns
Turn-on Rise Time	t_r		--	32.7	--	
Turn-off Delay Time	$t_{d(off)}$		--	52.2	--	
Turn-off Fall Time	t_f	(Note 2,3)	--	31.5	--	
Total Gate Charge	Q_g	V_{DS}=480V, I_D=7.0A, V_{GS}=10V	--	21.1	--	nC
Gate-Source Charge	Q_{gs}		--	4.53	--	
Gate-Drain Charge	Q_{gd}	(Note 2,3)	--	10.0	--	

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	--	--	7.0	A
Pulsed Source Current	I_{SM}		--	--	28	
Diode Forward Voltage	V_{SD}	I_S=7.0A,V_{GS}=0V	--	--	1.4	V
Reverse Recovery Time	T_{rr}	I_S=7.0A,V_{GS}=0V, dI$_F$/dt=100A/µS	--	482	--	ns
Reverse Recovery Charge	Q_{rr}		--	2.9	--	µC

Notes:

1. L=30mH, I_{AS}=5.16A, 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
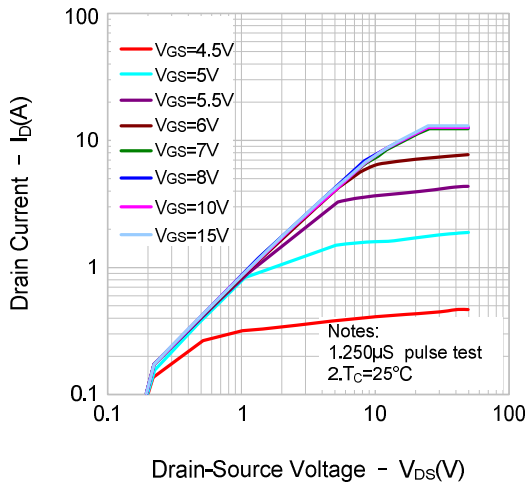
Figure 2. Transfer Characteristics
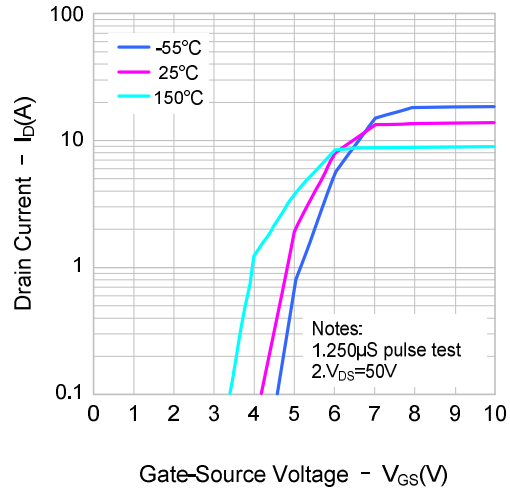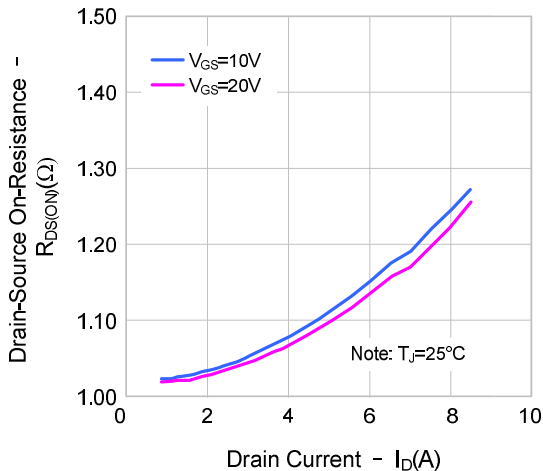

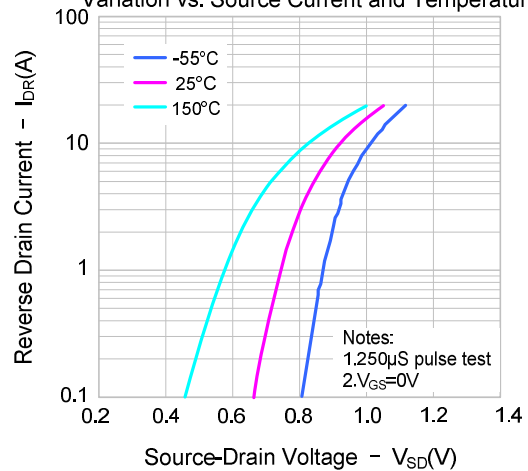Figure 3. On-Resistance Variation vs. Drain Current

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

TYPICAL CHARACTERISTICS(continued)
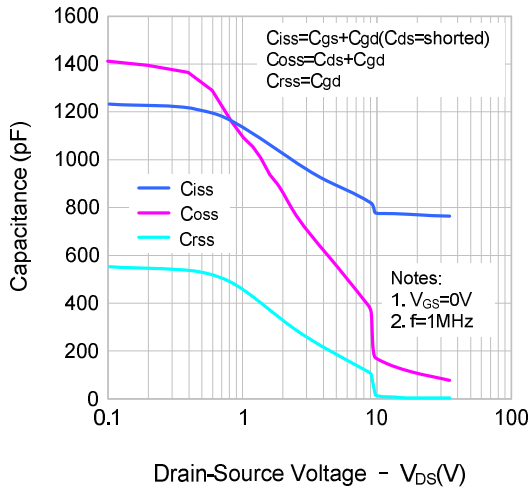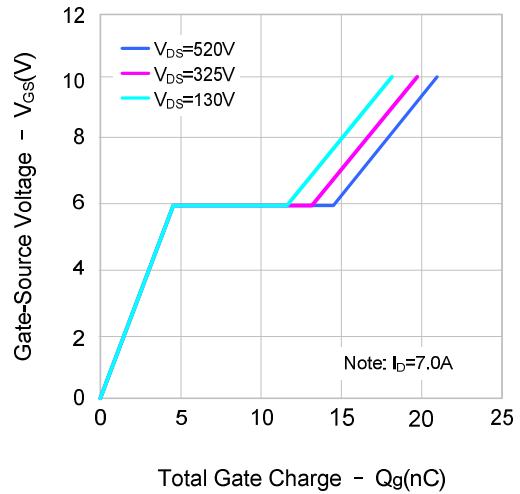
Figure 5. Capacitance Characteristics

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

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

Ciss
Coss
Crss

Capacitance (pF) vs Drain-Source Voltage – V_{DS}(V)

Figure 6. Gate Charge Characteristics

V_{DS}=520V
V_{DS}=325V
V_{DS}=130V

Note: I_D=7.0A

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)
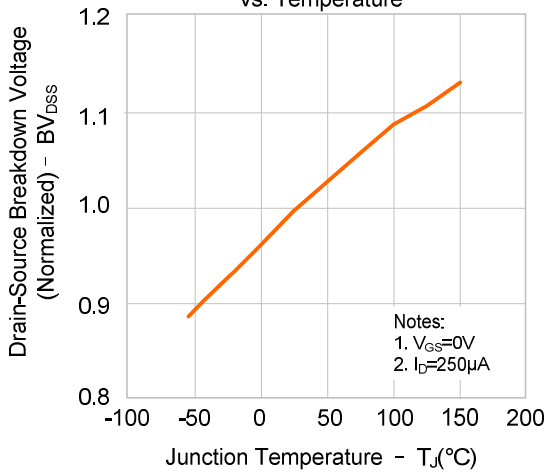
Figure 8. On-resistance vs. Temperature

Notes:
1. V_{GS}=10V
2. I_D=3.5A

Drain-Source On-Resistance (Normalized) – $R_{DS(ON)}$ vs Junction Temperature – T_J(°C)
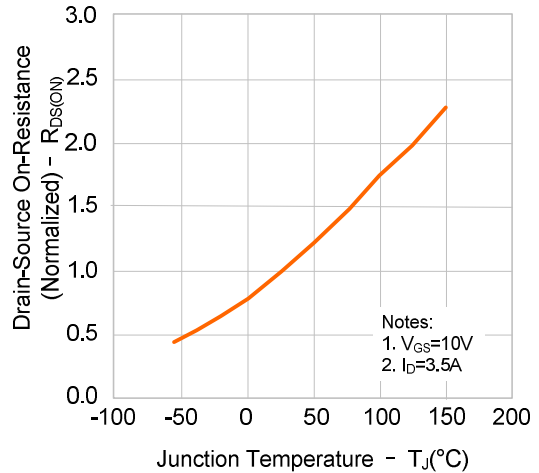
Figure 9-1. Max. Safe Operating Area(SVF7N60CF)

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

100μs
1ms
10ms
DC

Notes:
1. T_C=25°C
2. T_J=150°C
3. $R_{DS(ON)}$[max]=1.2Ω

Drain Current - I_D(A) vs Drain-Source Voltage - V_{DS}(V)
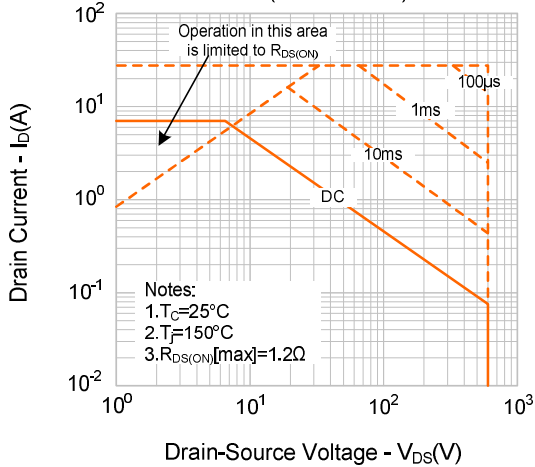
Figure 9-2. Max. Safe Operating Area(SVF7N60CS/K)

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

100μs
1ms
10ms
DC

Notes:
1. T_C=25°C
2. T_J=150°C
3. $R_{DS(ON)}$[max]=1.2Ω

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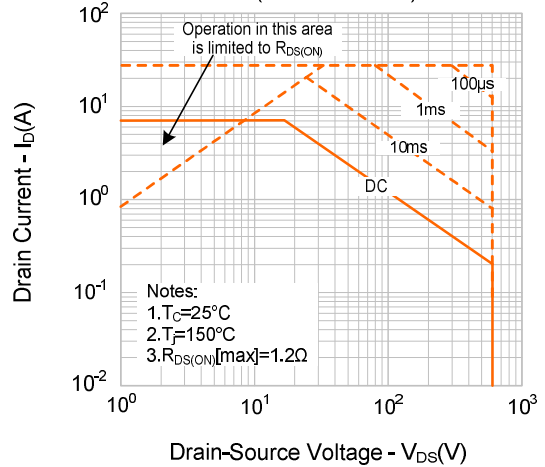
TYPICAL CHARACTERISTICS(continued)

Figure 9-3. Max. Safe Operating
Area(SVF7N60CMJ)

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

100μs
1ms
10ms
DC

Notes:
1.T_C=25°C
2.T_J=150°C
3.$R_{DS(ON)}$[max]=1.2Ω

Drain Current - I_D(A)
Drain-Source Voltage - V_{DS}(V)
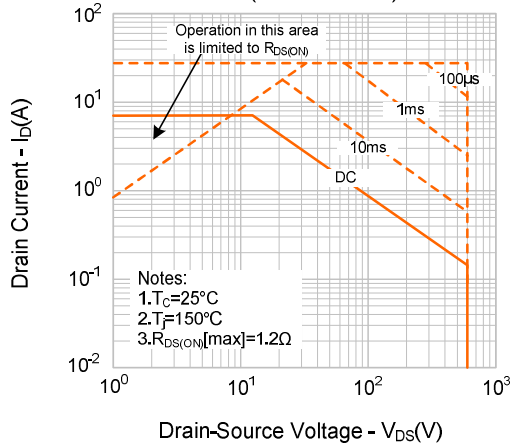
Figure 9-4. Max. Safe Operating
Area(SVF7N60CD)

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

100μs
1ms
10ms
DC

Notes:
1.T_C=25°C
2.T_J=150°C
3.$R_{DS(ON)}$[max]=1.2Ω

Drain Current - I_D(A)
Drain-Source Voltage - V_{DS}(V)
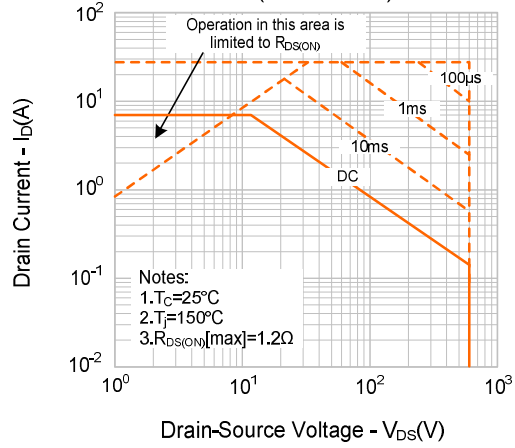
Figure 9-5. Max. Safe Operating
Area(SVF7N60CT)

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

100μs
1ms
10ms
DC

Notes:
1.T_C=25°C
2.T_J=150°C
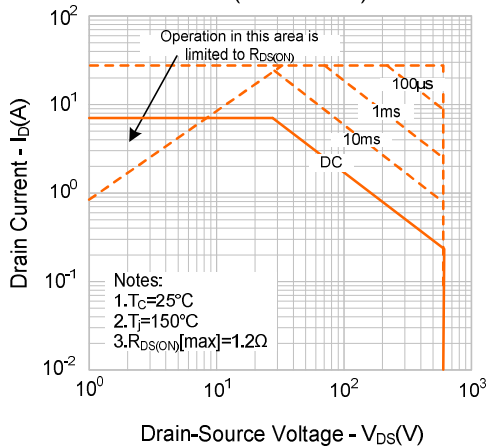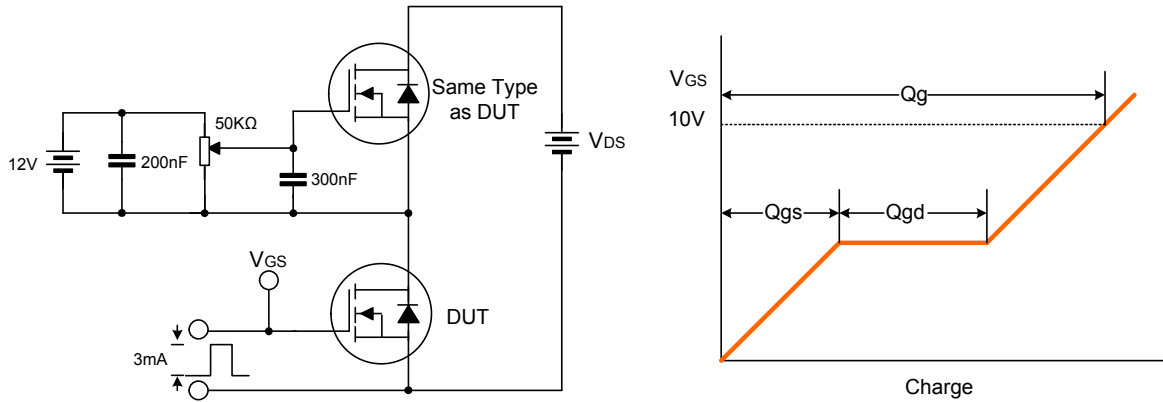3.$R_{DS(ON)}$[max]=1.2Ω

Drain Current - I_D(A)
Drain-Source Voltage - V_{DS}(V)

Figure 10. Max. Drain Current vs. Case
Temperature

Drain Current - I_D(A)
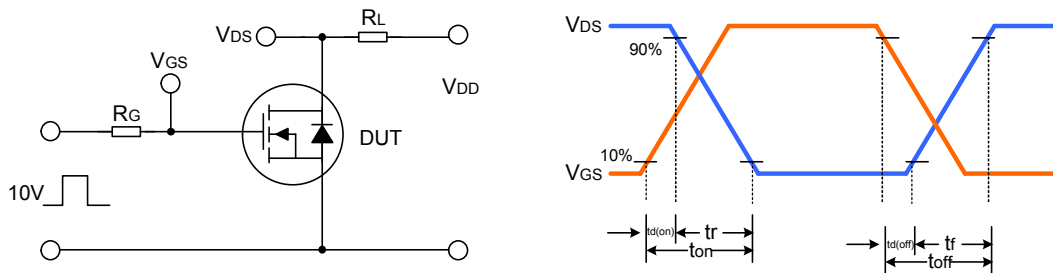Case Temperature－T_C(°C)
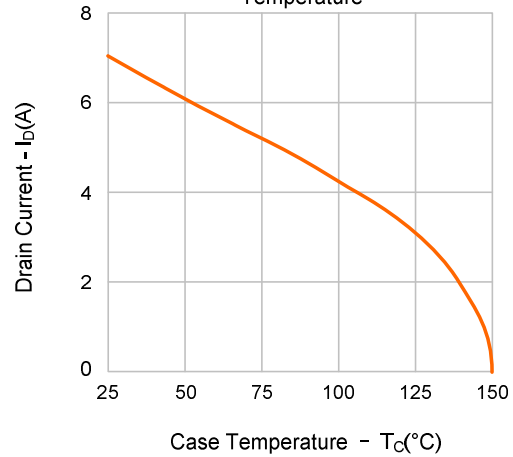
TYPICAL TEST CIRCUIT

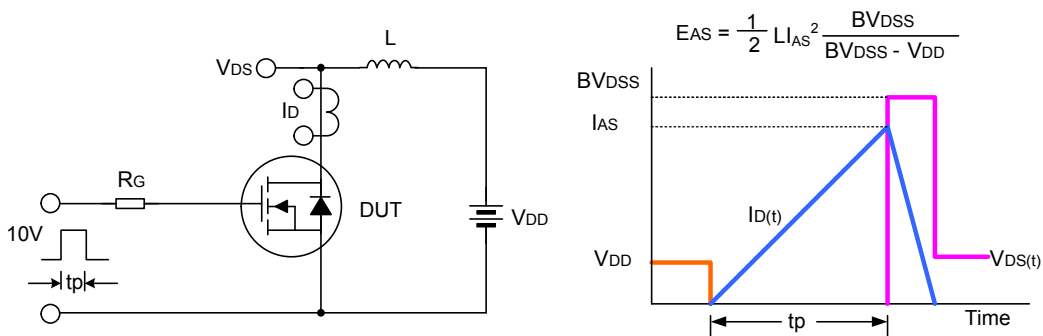Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveform

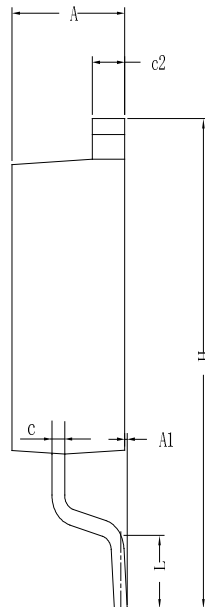
Unclamped Inductive Switching Test Circuit & Waveform

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

PACKAGE OUTLINE

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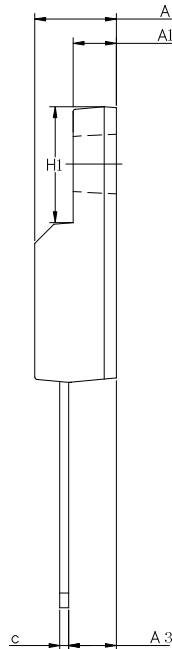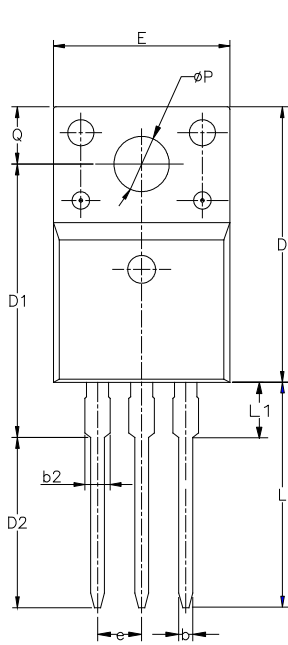
SYMBOL	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.70	0.80	0.90
b2	—	—	1.47
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	15.30	15.75	16.30
D2	9.30	9.80	10.30
E	9.73	10.16	10.36
e		2.54BCS	
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	/	/	3.50
øP	3.00	3.18	3.40
Q	3.05	3.30	3.55

TO-263-2L UNIT: mm
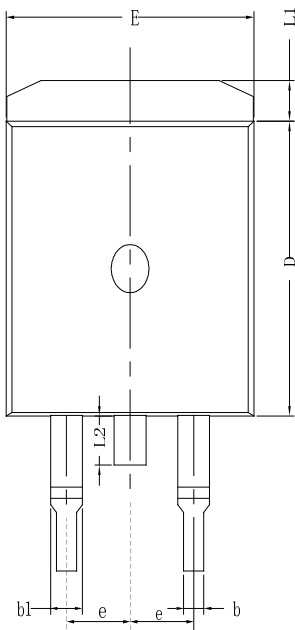
SYMBOL	MIN	NOM	MAX
A	4.30	4.57	4.72
A1	0	0.10	0.25
b	0.71	0.81	0.91
c	0.30	----	0.60
c2	1.17	1.27	1.37
D	8.50	----	9.35
E	9.80	----	10.45
e		2.54BSC	
H	14.70	----	15.75
L	2.00	2.30	2.74
L1	1.12	1.27	1.42
l2	----	----	1.75

PACKAGE OUTLINE(continued)

TO-262-3L   **UNIT: mm**
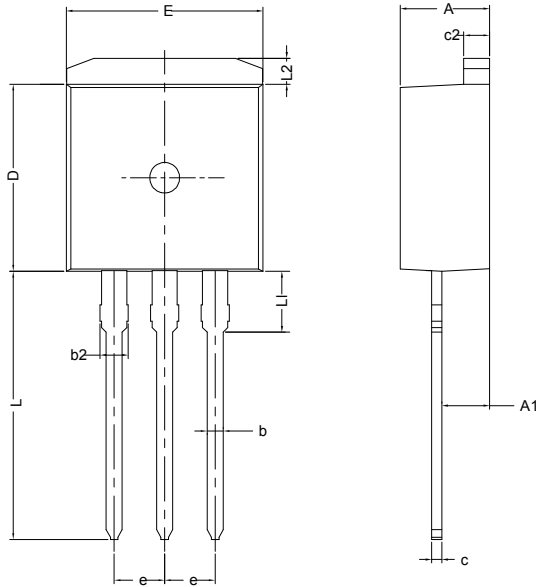
SYMBOL	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	2.20	---	2.92
b	0.71	0.80	0.97
b2	1.20	---	1.50
c	0.34	---	0.76
c2	1.22	1.30	1.35
D	8.38	---	9.30
E	9.80	10.16	10.54
e	2.54 BSC		
L	12.80	---	14.10
L1	2.80	3.30	4.06
L2	1.12	---	1.42

TO-251J-3L   **UNIT: mm**
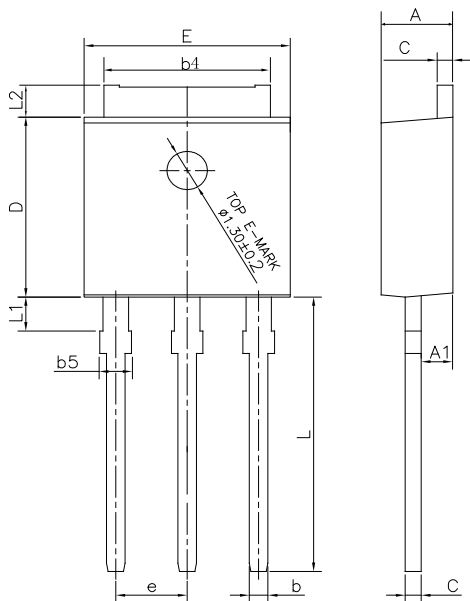
SYMBOL	MIN	NOM	MAX
A	2.18	2.30	2.39
A1	0.89	1.00	1.14
b	0.56	---	0.89
b4	4.95	5.33	5.46
b5	---	---	1.05
c	0.46	---	0.61
D	5.97	6.10	6.27
E	6.35	6.60	6.73
e	2.29 BCS		
L	8.89	9.30	9.65
L1	0.95	---	1.50
L2	0.89	---	1.27

PACKAGE OUTLINE(continued)

TO-252-2L   UNIT: mm
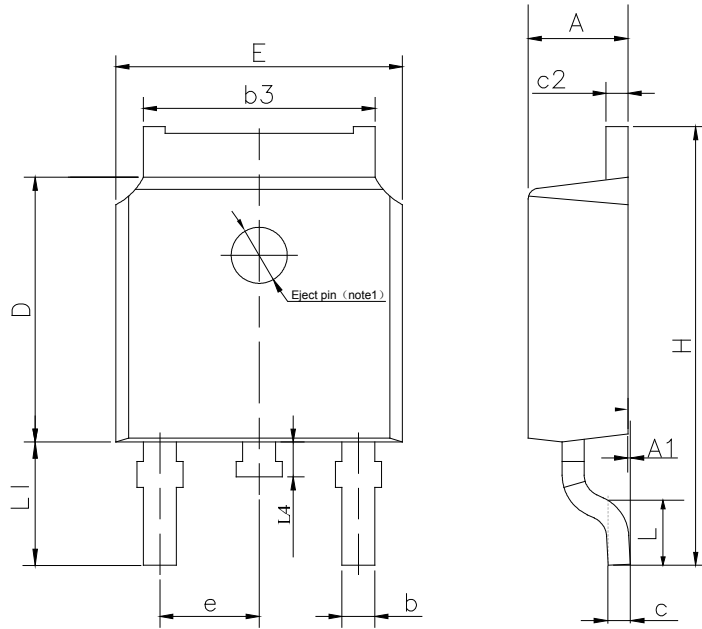
SYMBOL	MIN	NOM	MAX
A	2.10	2.30	2.50
A1	0	---	0.127
b	0.66	0.76	0.89
b3	5.10	5.33	5.46
c	0.45	---	0.65
c2	0.45	---	0.65
D	5.80	6.10	6.40
E	6.30	6.60	6.90
e		2.30TYP	
H	9.60	10.10	10.60
L	1.40	1.50	1.70
L1		2.90REF	
L4	0.60	0.80	1.00

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

TO-220-3L   UNIT: mm
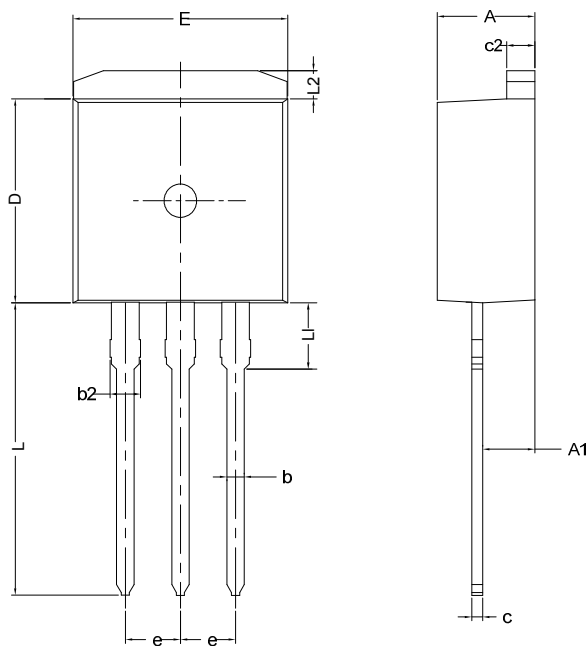
SYMBOL	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	2.20	---	2.92
b	0.71	0.80	0.97
b2	1.20	---	1.50
c	0.34	---	0.76
c2	1.22	1.30	1.35
D	8.38	---	9.30
E	9.80	10.16	10.54
e		2.54 BSC	
L	12.80	---	14.10
L1	2.80	3.30	4.06
L2	1.12	---	1.42

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.:	SVF7N60CF/S/K/MJ/D/T	Document Type:	Datasheet
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Rev.:　　　　1.7

Revision History:

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

Rev.:　　　　1.6

Revision History:

　　1.　Add the package information of TO-220-3L

Rev.:　　　　1.5

Revision History:

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

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

　　3.　Modify the package information of TO-263-2L

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 packages of TO-252-2L

Rev.:　　　　1.2

Revision History:

　　1.　Add the packages of TO-263-2L, TO-262-3L and TO-251J-3L

Rev.:　　　　1.1

Revision History:

　　1.　Modify the thermal characteristics

Rev.:　　　　1.0

Revision History:

　　1.　First release