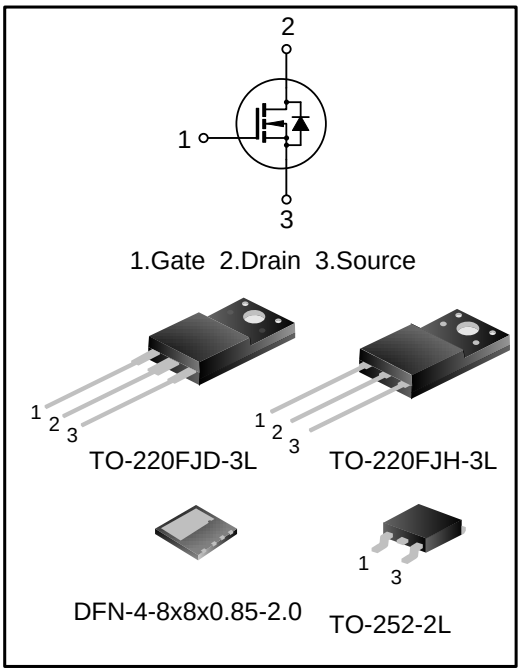
11A, 600V SUPER JUNCTION MOS POWER TRANSISTOR

DESCRIPTION

SVS60R360FJH(FJD)(D)(L8A)E3 is an N-channel enhancement mode high voltage power MOSFETs produced using Silan's super junction MOS technology. It achieves low conduction loss and switching losses. It leads the design engineers to their power converters with high efficiency, high power density, and superior thermal behavior.

Furthermore, it's universal applicable, i.e., suitable for hard and soft switching topologies.



FEATURES

- 11A, 600V, $R_{DS(on)(typ.)}$=0.3Ω@V_{GS}=10V
- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme dv/dt rated
- High peak current capability
- 100% avalanche tested
- Pb-free lead plating
- RoHS compliant

KEY PERFORMANCE PARAMETERS

Characteristics	Ratings	Unit
V_{DS}	600	V
$V_{GS(th)}$	2.0~4.0	V
$R_{DS(on),max.}$	0.36	Ω
$I_{D.pulse}$	44	A
$Q_{g.typ.}$	27	nC

ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing Type
SVS60R360FJHE3	TO-220FJH-3L	6036FJHE3	Halogen free	Tube
SVS60R360FJDE3	TO-220FJD-3L	60R360FDE3	Halogen free	Tube
SVS60R360DE3TR	TO-252-2L	60R36DE3	Halogen free	Tape&Reel
SVS60R360L8AE3TR	DFN-4-8x8x0.85-2.0	60R360E3	Halogen free	Tape&Reel

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

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Drain-source Voltage	V_{DS}	--	600	--	--	V
Gate-source Voltage (Static)	V_{GS}	--	-30	--	30	V
Gate-source Voltage (Dynamic)	V_{GS}	AC(f>1 Hz)	-30	--	30	V
Drain Current	I_D	T_C=25°C	--	--	11	A
		T_C=100°C	--	--	7	A
Drain Current Pulsed (Note 1)	I_{DM}	T_C=25°C	--	--	44	A
Power Dissipation (TO-220FJH-3L) (TO-220FJD-3L) (Note 2)	P_D	T_C=25°C	--	--	31	W
Power Dissipation (TO-252-2L) DFN-4-8x8x0.85-2.0 (Note 2)	P_D	T_C=25°C	--	--	104	W
Single Pulsed Avalanche Energy	E_{AS}	L=79mH, V_{DD}=100V, R_G=25Ω, starting temperature T_J=25°C	--	--	310	mJ
Single Pulsed Avalanche Current	I_{AS}	--	--	--	2.6	A
Reverse Diode dv/dt	dv/dt	V_{DS}=0~400V, I_{SD}<= I_S, T_J=25°C	--	--	50	V/ns
MOSFET dv/dt Ruggedness	dv/dt	V_{DS}=0~480V	--	--	100	V/ns
Operation Junction Temperature Range	T_J	--	-55	--	150	°C
Storage Temperature Range	T_{stg}	--	-55	--	150	°C
Continuous Diode Forward Current	I_S	T_C=25°C, integral reverse P-N junction diode in the MOSFET	--	--	11	A
Diode Pulse Current	$I_{S,pulse}$		--	--	44	A
Maximum Diode Commutation Speed	di/dt	V_{DS}=0~400V, I_{SD}<=I_S, T_J=25°C	--	--	250	A/μs

THERMAL CHARACTERISTICS

Table1. Thermal characteristics of TO-220FJH-3L/TO-220FJD-3L (SVS60R360FJH/FJDE3)

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	4.1	°C/W
Thermal Resistance, Junction-ambient	$R_{\theta JA}$	--	--	--	62.5	°C/W
Soldering Temperature (in line)	T_{sold}	15^{+2}_{-0} sec, 1time	--	--	260	°C

Table2. Thermal characteristics of TO-252-2L/ DFN-4-8x8x0.85-2.0 (SVS60R360D/L8AE3)

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	1.2	°C/W
Thermal Resistance, Junction-ambient	$R_{\theta JA}$	--	--	--	62.0	°C/W
Soldering Temperature (SMD)	T_{sold}	Reflow soldering:10±1sec, 3times Wave soldering: 10^{+2}_{-0} sec, 1time	--	--	260	°C

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

Static characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
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, T_J=25°C	--	--	1.0	μA
		V_{DS}=600V, V_{GS}=0V, T_J=125°C	--	1.5	--	
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=5.5A	--	0.3	0.36	Ω
Gate Resistance	R_G	f=1MHz	--	3.7	--	Ω

Dynamic characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Input Capacitance	C_{iss}	f=1MHz, V_{GS}=0V, V_{DS}=100V	--	929	--	pF
Output Capacitance	C_{oss}		--	38	--	
Reverse Transfer Capacitance	C_{rss}		--	1.0	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=300V, V_{GS}=10V, R_G=10Ω, I_D=11A (Notes 3,4)	--	14	--	ns
Turn-on Rise Time	t_r		--	30	--	
Turn-off Delay Time	$t_{d(off)}$		--	43	--	
Turn-off Fall Time	t_f		--	25	--	
Total Gate Charge	Q_g	V_{DD}=480V, V_{GS}=10V, I_D=11A (Notes 3,4)	--	27	--	nC
Gate-source Charge	Q_{gs}		--	7.4	--	
Gate-drain Charge	Q_{gd}		--	12	--	
Gate-plateau Voltage	$V_{plateau}$		--	6.7	--	V

Reverse diode characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	V_{SD}	I_S=11A, V_{GS}=0V	--	--	1.4	V
Reverse Recovery Time	T_{rr}	I_S=11A, V_{GS}=0V, dI_F/dt=100A/μs (Note 3)	--	306	--	ns
Reverse Recovery Charge	Q_{rr}		--	3.7	--	μC
Reverse Recovery Peak Current	I_{rrm}		--	24	--	A

Notes:

1. Pulse time 5μs;
2. The dissipation power will change with temperature, derating above 25°C:
   0.24W/°C(TO-220FJH-3L)(TO-220FJD-3L)/ 0.83W/°C(TO-252-2L)(DFN-4-8x8x0.85-2.0);
3. Pulse Test: Pulse width ≤300μs, Duty cycle≤2%;
4. Essentially independent of operating temperature.

TYPICAL CHARACTERISTICS

Figure 1. On-Region Characteristics

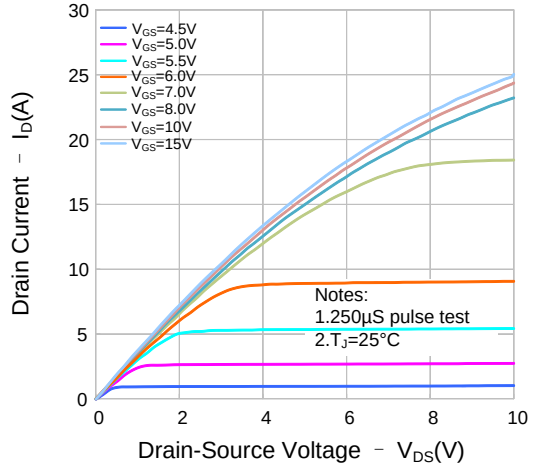


Figure 2. On-Region Characteristics

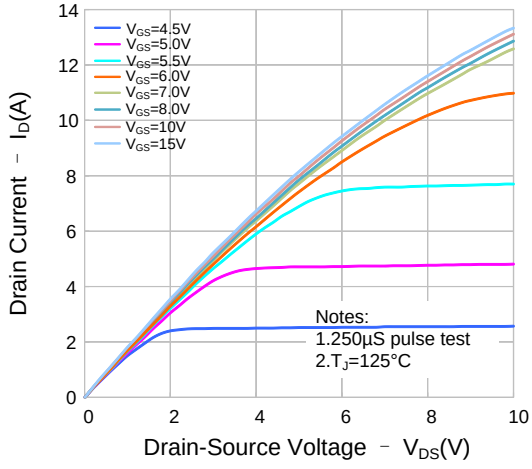


Figure 3. Transfer Characteristics

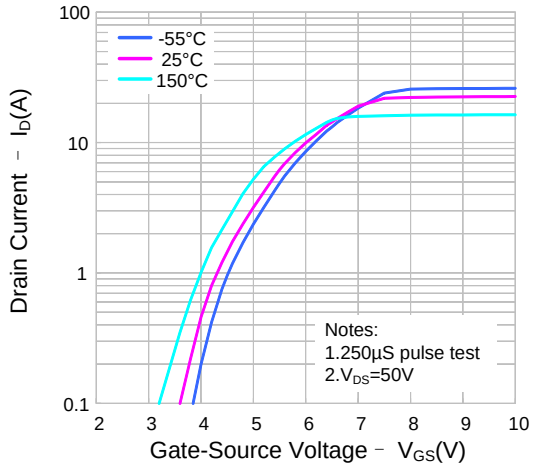


Figure 4. On-ResisTance Variation vs. Drain Current

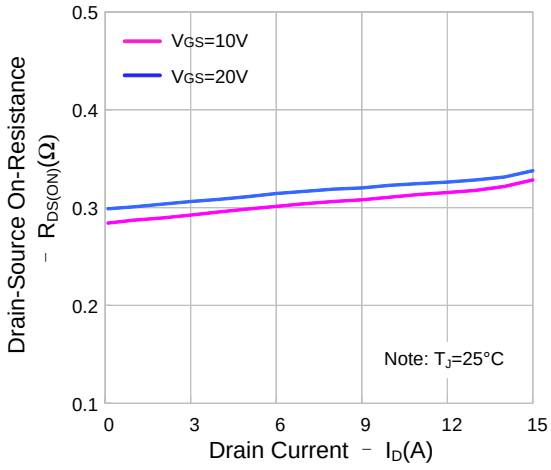


Figure 5. On-Resistance Variation vs. Gate-Source Voltage

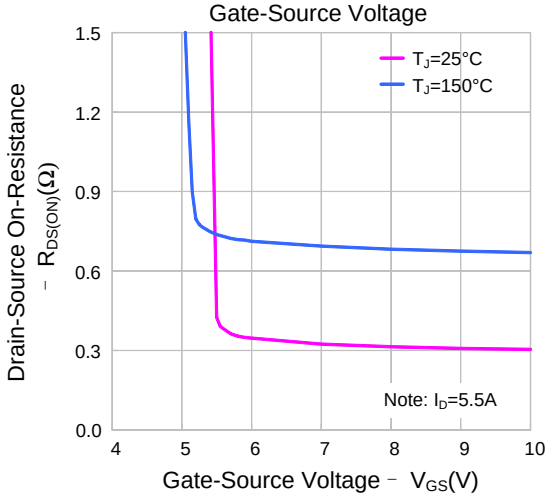
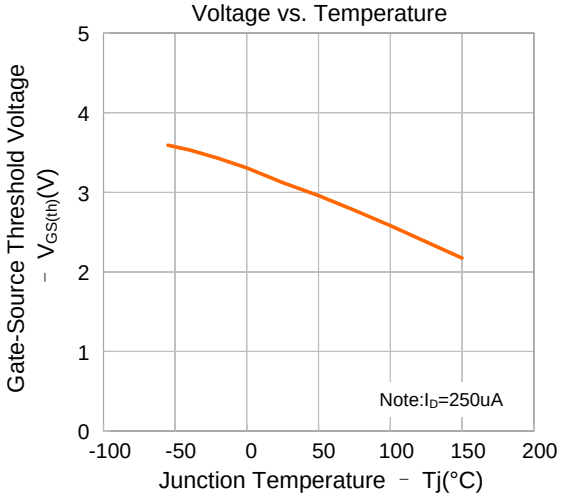


Figure 6. Gate-Source Threshold Voltage vs. Temperature



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 7. Body Diode Forward Voltage Variation vs. Source Current and Temperature

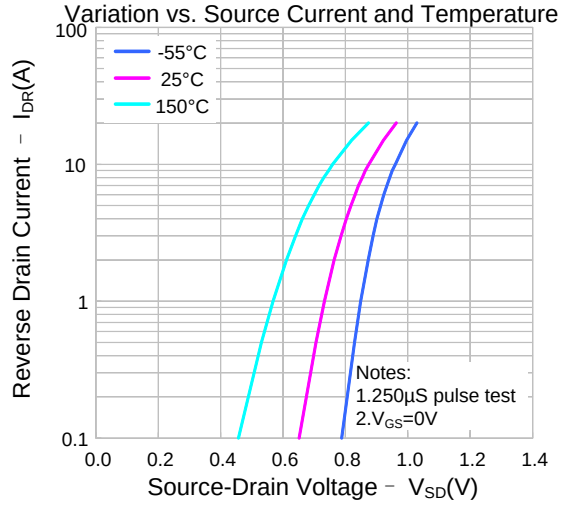


Figure 8. Capacitance Characteristics

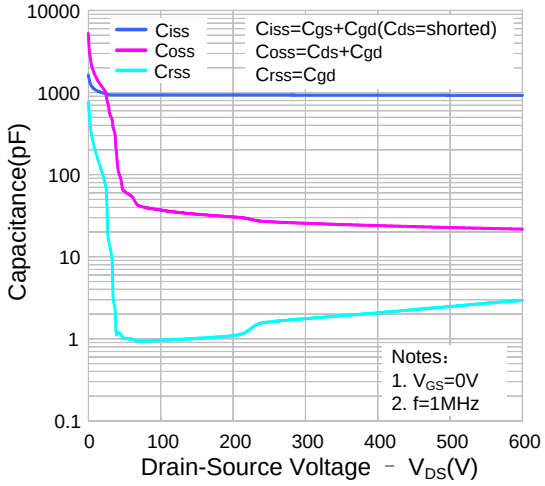


Figure 9. Gate Charge Characteristics

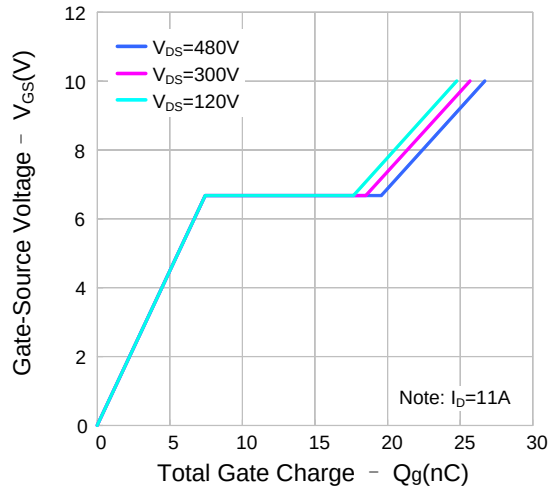


Figure 10. Breakdown Voltage Variation vs. Temperature

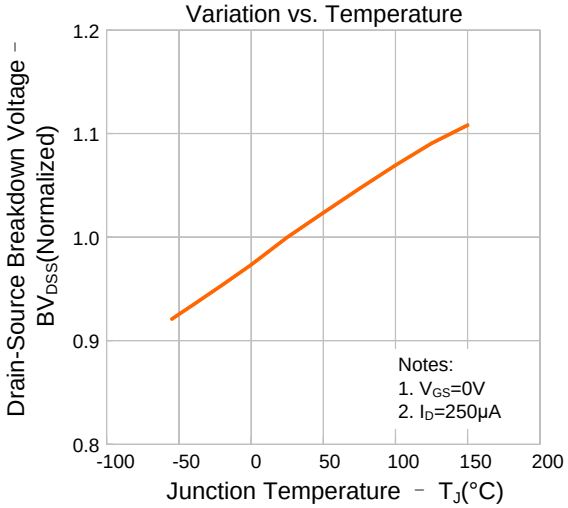


Figure 11. On-resistance Variation vs. Temperature

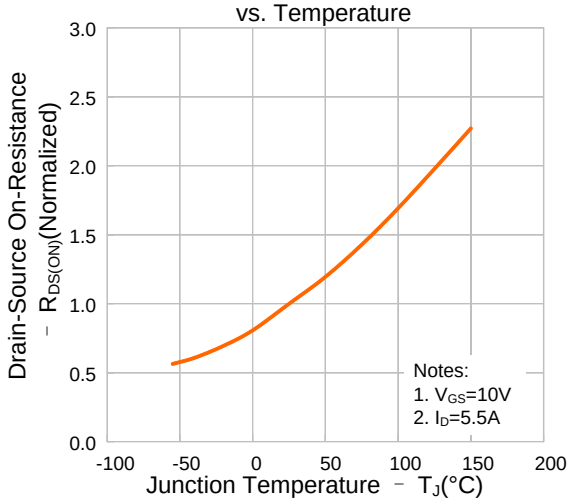
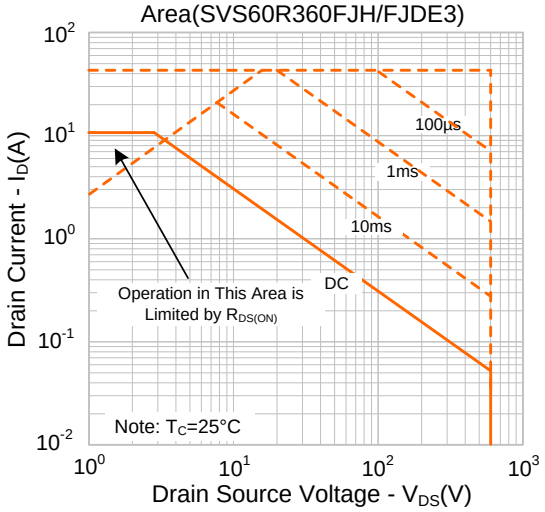


Figure 12-1. Max. Safe Operating Area(SVS60R360FJH/FJDE3)



TYPICAL CHARACTERISTICS (CONTINUED)

Figure 12-2. Max. Safe Operating Area(SVS60R360D/L8AE3)

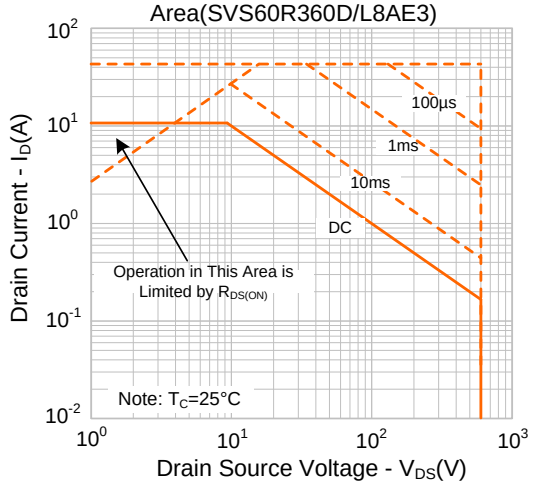


Figure 13-1. Power Dissipation vs. TemperatureSVS60R360FJH/FJDE3)

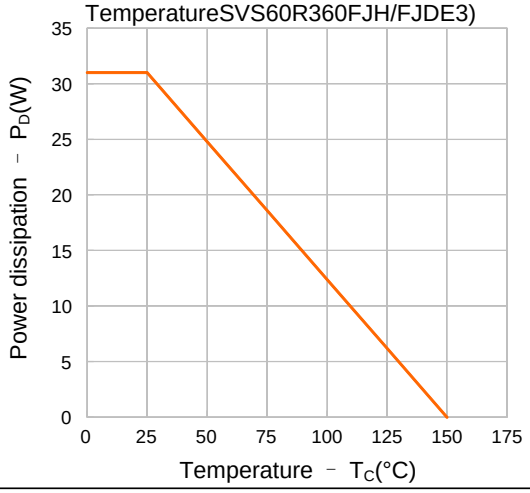
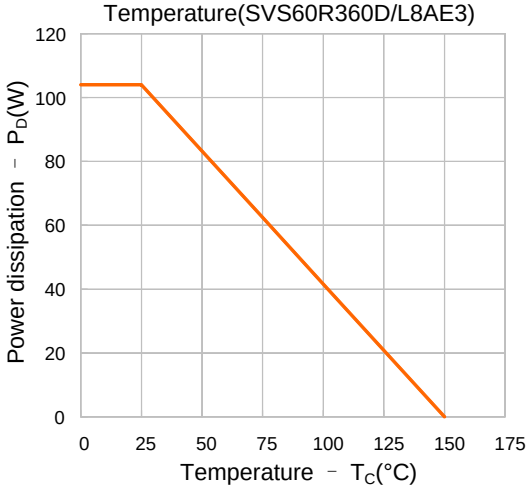
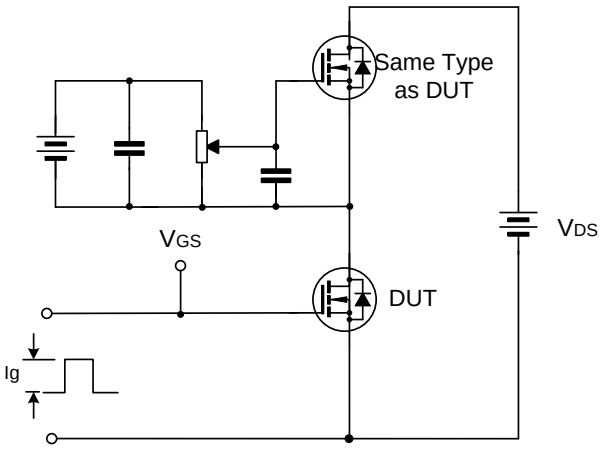


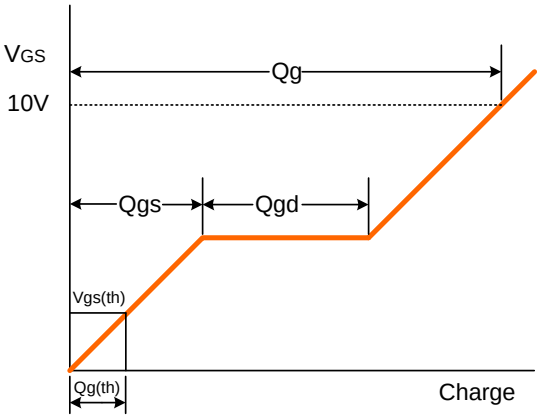
Figure 13-2. Power Dissipation vs. Temperature(SVS60R360D/L8AE3)



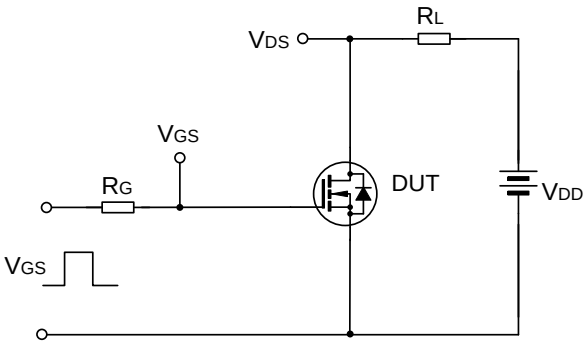
TYPICAL TEST CIRCUIT

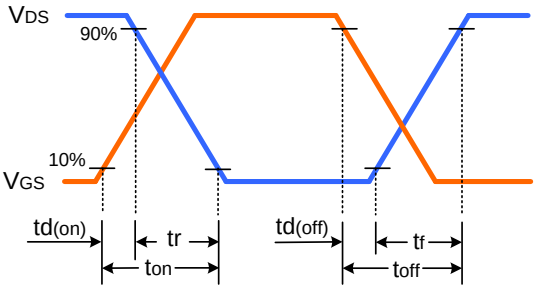
Gate Charge Test Circuit & Waveform



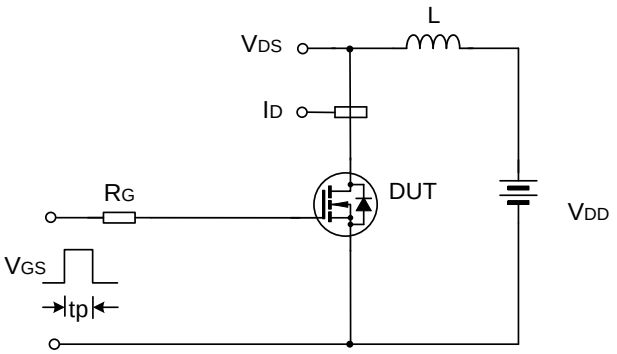


Resistive Switching Test Circuit & Waveform

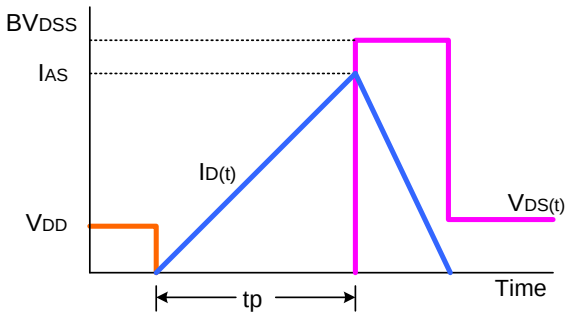




Unclamped Inductive Switching Test Circuit & Waveform

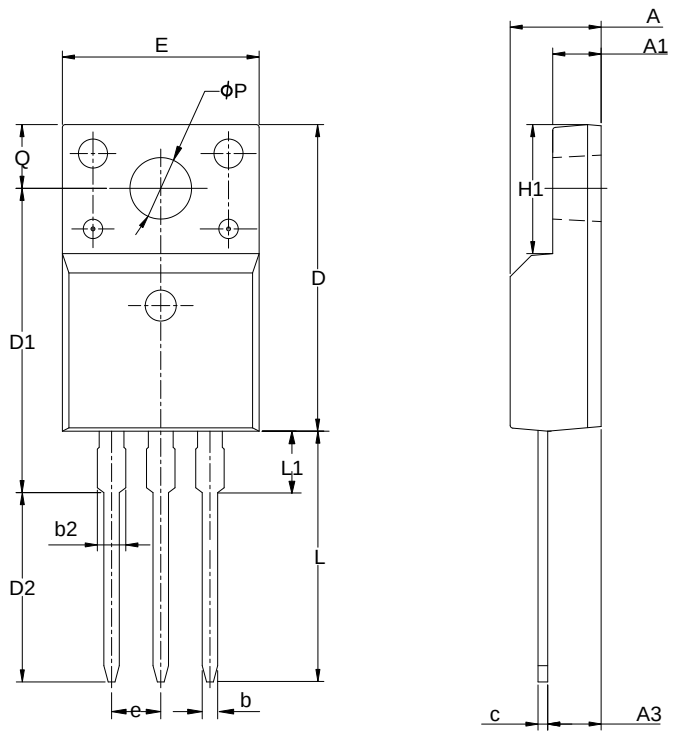


$$E_{AS} = \frac{1}{2} LI_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



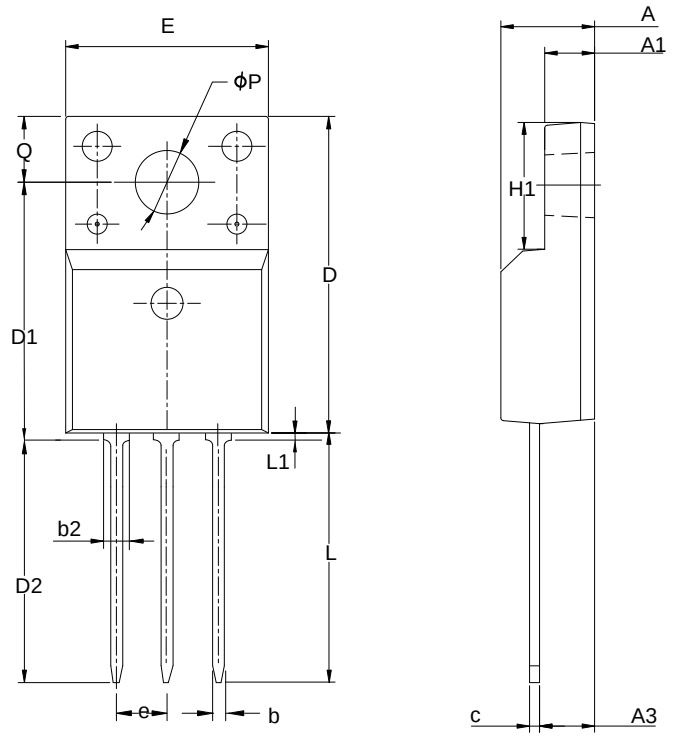
PACKAGE OUTLINE

TO-220FJD-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	0.55	0.70	0.85
b2	—	—	1.29
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	13.97	14.47	14.97
D2	10.58	11.08	11.58
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	—	—	2.00
ϕP	3.00	3.18	3.40
Q	3.05	3.30	3.55

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

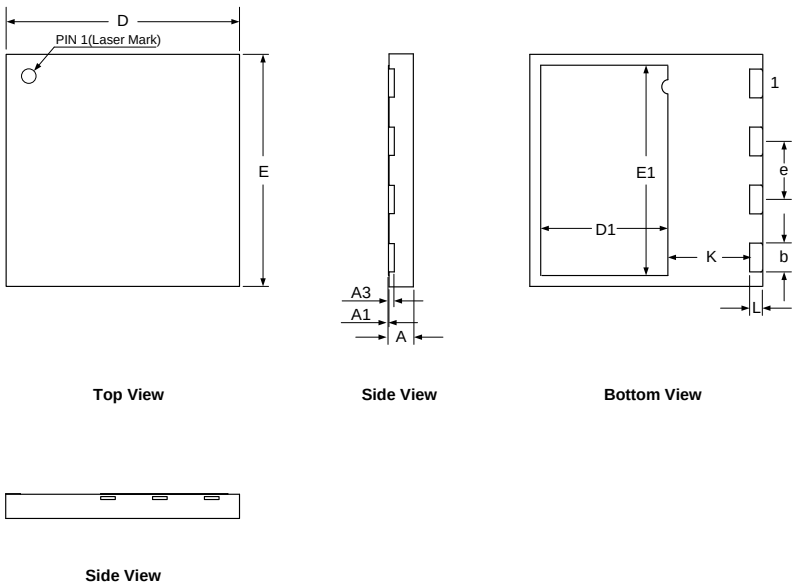


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.55	0.70	0.80
b2	—	—	1.29
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	12.87	13.07	13.27
D2	12.28	12.48	12.68
E	9.73	10.16	10.36
e	2.54BCS		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	—	—	0.85
ϕP	3.00	3.18	3.40
Q	3.05	3.30	3.55

PACKAGE OUTLINE(CONTINUED)

DFN-4-8x8x0.85-2.0

UNIT: mm



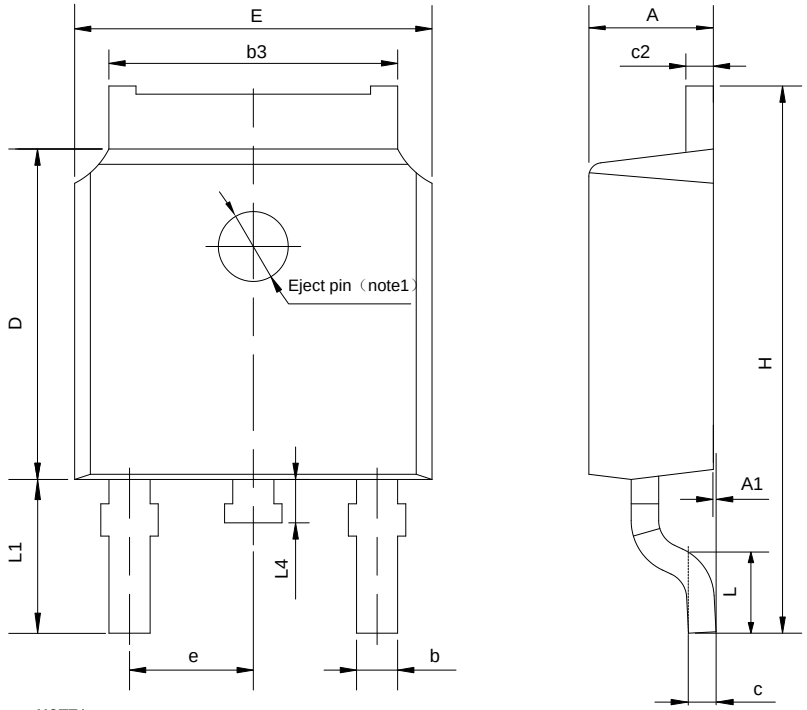
Top View　　Side View　　Bottom View

Side View

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.80	0.85	0.90
A1	0.00	0.02	0.05
A3		0.20 REF	
b	0.90	1.00	1.10
D	7.90	8.00	8.10
D1	4.25	4.35	4.45
E	7.90	8.00	8.10
E1	7.10	7.20	7.30
e	1.90	2.00	2.10
K	2.65	2.75	2.85
L	0.40	0.50	0.60

TO-252-2L

UNIT: mm



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

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

Important notice :

1. **The instructions are subject to change without notice!**
2. **Customers should obtain the latest relevant information before placing orders and should verify that such information is complete and current. Please read the instructions carefully before using our products, including the circuit operation precautions.**
3. **Our products are consumer electronic products or the other civil electronic products.**
4. **When using our products, please do not exceed the maximum rating of the products, otherwise the reliability of the whole machine will be affected. There is a certain possibility of failure or malfunction of any semiconductor product under specific conditions. The buyer is responsible for complying with safety standards and taking safety measures when using our products for system design, sample and whole machine manufacturing, so as to avoid potential failure risk that may cause personal injury or property loss.**
5. **It is strongly recommended to identify the trademark when buying our products. Please contact us if there is any question.**
6. **Product promotion is endless, our company will wholeheartedly provide customers with better products!**
7. **Website: http: //www.silan.com.cn**

Part No.:	SVS60R360FJH(FJD)(D)(L8A)E3	Document Type:	Datasheet
Copyright:	HANGZHOU SILAN MICROELECTRONICS CO.,LTD	Website:	http: //www.silan.com.cn

Rev.: 1.3

Revision History:

1. Update package outline of DFN-4-8x8x0.85-2.0

Rev.: 1.2

Revision History:

1. Add SVS60R360L8AE3(DFN-4-8x8x0.85-2.0) package
2. Update figures 12-1 and 13-1

Rev.: 1.1

Revision History:

1. Add SVS60R360FJDE3 (TO-220FJD-3L) and SVS60R360DE3 (TO-252-2L) package
2. Update curve template
3. Update important notice

Rev.: 1.0

Revision History:

1. First release