



20A, 600V SUPER JUNCTION MOS POWER TRANSISTOR

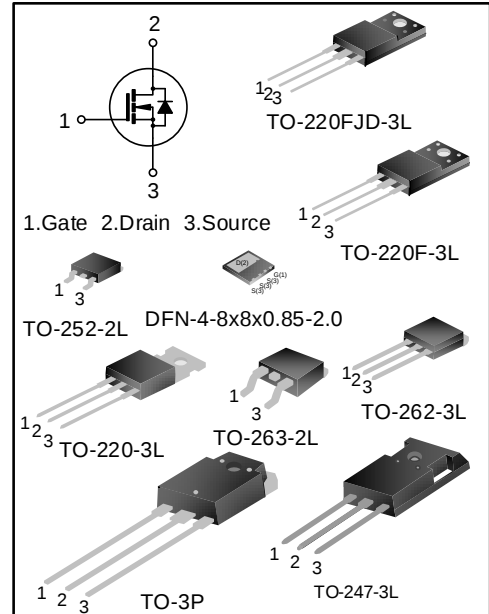
DESCRIPTION

SVS60R190FJD(F)(D)(L8A)(T)(S)(K)(P7)(PN)D4 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

- 20A, 600V, $R_{DS(on)(typ.)}=0.165\Omega@V_{GS}=10V$
- 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
$R_{DS(on),max.}$	0.19	Ω
$I_{D,pulse}$	80	A
$Q_{g,typ.}$	31	nC

ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing Type
SVS60R190FJDD4	TO-220FJD-3L	60R190FDD4	Halogen free	Tube
SVS60R190FD4	TO-220F-3L	60R190FD4	Halogen free	Tube
SVS60R190DD4TR	TO-252-2L	60R190D4	Halogen free	Tape & Reel
SVS60R190L8AD4TR	DFN-4-8x8x0.85-2.0	60R190D4	Halogen free	Tape & Reel
SVS60R190TD4	TO-220-3L	60R190TD4	Halogen free	Tube



SVS60R190SD4	TO-263-2L	60R190D4	Halogen free	Tube
SVS60R190SD4TR	TO-263-2L	60R190D4	Halogen free	Tape & Reel
SVS60R190KD4	TO-262-3L	60R190D4	Halogen free	Tube
SVS60R190P7D4	TO-247-3L	60R190D4	Halogen free	Tube
SVS60R190PND4	TO-3P	60R190D4	Halogen free	Tube

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}	--	-20	--	20	V
Gate-source Voltage (Dynamic)	V _{GS}	AC(f>1Hz)	-30	--	30	V
Drain Current	I _D	T _C =25°C	--	--	20	A
		T _C =100°C	--	--	12	A
Drain Current Pulsed (Note 1)	I _{DM}	T _C =25°C	--	--	80	A
Power Dissipation(TO-220F-3L) (TO-220FJD-3L) (Note 2)	P _D	T _C =25°C	--	--	25	W
Power Dissipation (TO-252-2L) (Note 2)	P _D	T _C =25°C	--	--	139	W
Power Dissipation (DFN-4-8x8x0.85-2.0) (Note 2)	P _D	T _C =25°C	--	--	171	W
Power Dissipation (TO-220-3L) (TO-263-2L) (TO-262-3L) (Note 2)	P _D	T _C =25°C	--	--	156	W
Power Dissipation (TO-247-3L) (TO-3P) (Note 2)	P _D	T _C =25°C	--	--	167	W
Single Pulsed Avalanche Energy	E _{AS}	L=79mH, V _{DD} =100V, R _G =25Ω, starting temperature T _J =25°C	--	--	470	mJ
Single Pulsed Current	I _{AS}	--	--	--	3.2	A
Reverse Diode dv/dt	dv/dt	V _{DS} =0~400V, I _{SD} ≤I _S , T _J =25°C	--	--	15	V/ns
MOSFET dv/dt Ruggedness	dv/dt	V _{DS} =0~480V	--	--	50	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	--	--	20	A
Diode Pulse Current	I _{S,pulse}		--	--	80	A
Maximum Diode Commutation Speed	di/dt	V _{DS} =0~400V, I _{SD} ≤I _S , T _J =25°C	--	--	500	A/μs



THERMAL CHARACTERISTICS

Table 1. TO-220FJD-3L/(TO-220F-3L) (SVS60R190FJD/FD4) thermal characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	5.0	°C/W
Thermal Resistance, Junction-ambient	$R_{\theta JA}$	--	--	--	62.5	°C/W
Soldering Temperature (in line)	T_{solder}	15 ⁺² ₋₀ sec, 1time	--	--	260	°C

Table 2. TO-252-2L (SVS60R190DD4) thermal characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	0.9	°C/W
Thermal Resistance, Junction-ambient	$R_{\theta JA}$	--	--	--	62.0	°C/W
Soldering Temperature (SMD)	T_{solder}	Reflow soldering: 10±1sec, 3times	--	--	260	°C

Table 3. DFN-4-8x8x0.85-2.0 (SVS60R190L8AD4) thermal characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	0.73	°C/W
Thermal Resistance, Junction-ambient	$R_{\theta JA}$	--	--	--	62.0	°C/W
Soldering Temperature (SMD)	T_{solder}	Reflow soldering: 10±1sec, 3times	--	--	260	°C

Table 4. TO-220-3L/TO-263-2L/TO-262-3L (SVS60R190T/S/KD4) thermal characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	0.8	°C/W
Thermal Resistance, Junction-ambient	$R_{\theta JA}$	--	--	--	62.5	°C/W
Soldering Temperature (in line)	T_{solder}	15 ⁺² ₋₀ sec, 1time	--	--	260	°C
Soldering Temperature (SMD)	T_{solder}	Reflow soldering: 10±1sec, 3times	--	--	260	°C



Table 5. TO-247-3L/TO-3P (SVS60R190P7/PND4) thermal characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	0.75	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-ambient	$R_{\theta JA}$	--	--	--	50	$^{\circ}\text{C/W}$
Soldering Temperature (in line)	T_{sold}	15^{+2}_{-0} sec, 1time	--	--	260	$^{\circ}\text{C}$



ELECTRICAL CHARACTERISTICS (UNLESS OTHERWISE NOTED, $T_J=25^{\circ}\text{C}$)

Static characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Drain-source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	600	--	--	V
Drain-source Leakage Current	I_{DSS}	$V_{DS}=600V, V_{GS}=0V, T_J=25^{\circ}\text{C}$	--	--	1.0	μA
		$V_{DS}=600V, V_{GS}=0V, T_J=150^{\circ}\text{C}$	--	10	--	
Gate-source Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	--	--	± 100	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	2.0	--	4.0	V
Static Drain-source On State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=10A, T_J=25^{\circ}\text{C}$	--	0.165	0.19	Ω
		$V_{GS}=10V, I_D=10A, T_J=150^{\circ}\text{C}$	--	0.37	--	
Gate Resistance	R_G	$f=1\text{MHz}$	--	4.7	--	Ω

Dynamic characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Input Capacitance	C_{iss}	$f=1\text{MHz}, V_{GS}=0V, V_{DS}=100V$	--	1177	--	pF
Output Capacitance	C_{oss}		--	53	--	
Reverse Transfer Capacitance	C_{rss}		--	1.1	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=300V, V_{GS}=10V, R_G=24\Omega, I_D=20A$ (Notes 3, 4)	--	22	--	ns
Turn-on Rise Time	t_r		--	51	--	
Turn-off Delay Time	$t_{d(off)}$		--	79	--	
Turn-off Fall Time	t_f		--	38	--	
Total Gate Charge	Q_g	$V_{DD}=480V, V_{GS}=10V, I_D=20A$ (Notes 3, 4)	--	31	--	nC
Gate-source Charge	Q_{gs}		--	9.7	--	
Gate-drain Charge	Q_{gd}		--	14	--	
Gate-plateau Voltage	$V_{plateau}$		--	7.1	--	V

Reverse diode characteristics

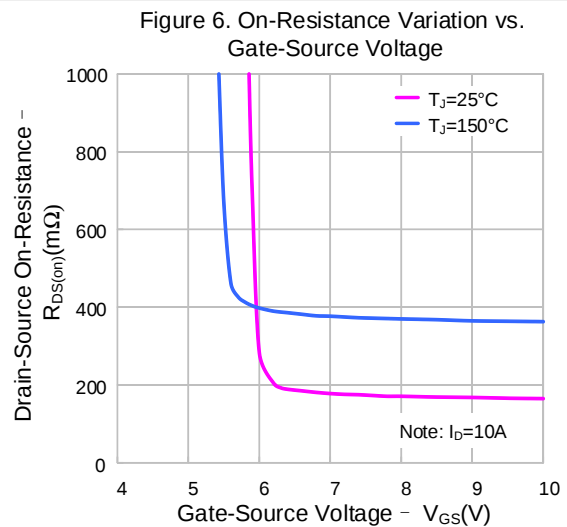
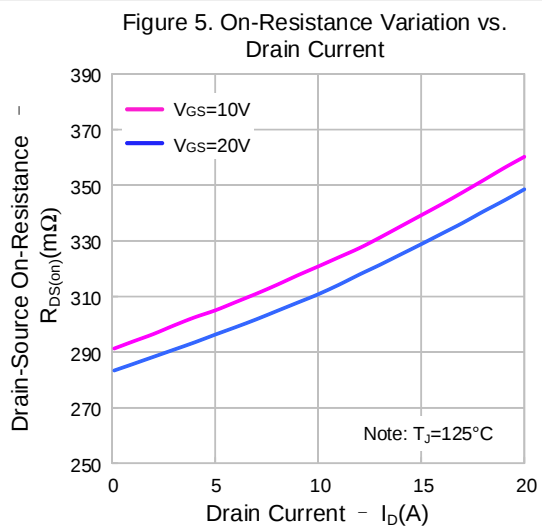
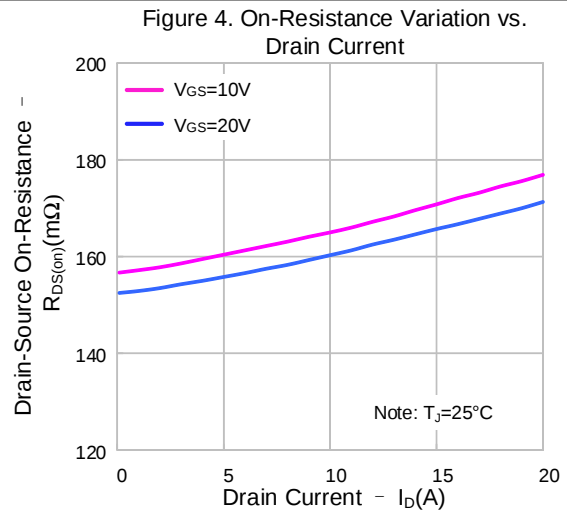
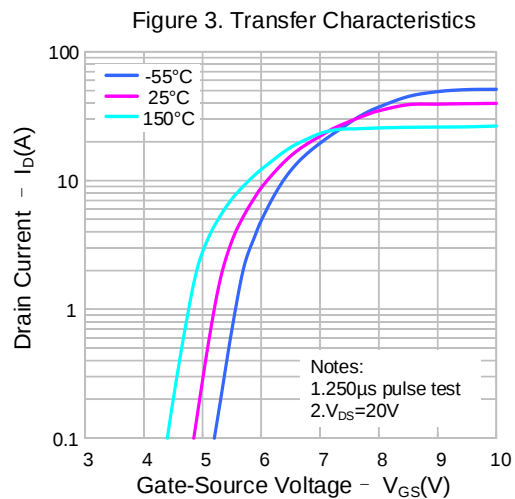
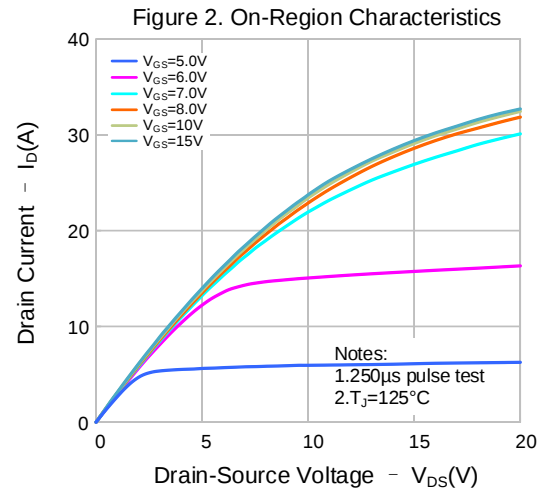
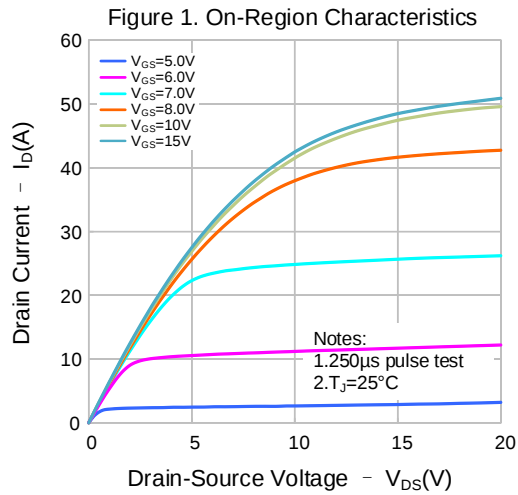
Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	V_{SD}	$I_S=20A, V_{GS}=0V$	--	--	1.4	V
Reverse Recovery Time	T_{rr}	$I_S=20A, V_{GS}=0V, V_R=50V,$ $di/dt=100A/\mu s$ (Note 3)	--	290	--	ns
Reverse Recovery Charge	Q_{rr}		--	4.2	--	μC
Reverse Recovery Peak Current	I_{rrm}		--	29	--	A

Notes:

- Pulse time $5\mu s$;
- The dissipation power will change with temperature, derating above 25°C :
 $0.20W/^{\circ}\text{C}$ (TO-220FJD-3L)(TO-220F-3L)/ $1.11W/^{\circ}\text{C}$ (TO-252-2L)/ $1.37W/^{\circ}\text{C}$ (DFN-4-8x8x0.85-2.0) /
 $1.25W/^{\circ}\text{C}$ (TO-220-3L)(TO-263-2L)(TO-262-3L)/ $1.33W/^{\circ}\text{C}$ (TO-247-3L)(TO-3P);
- Pulse Test: Pulse width $\leq 300\mu s$, Duty cycles $\leq 2\%$;
- Essentially independent of operating temperature.



TYPICAL CHARACTERISTICS





TYPICAL CHARACTERISTICS (CONTINUED)

Figure 7. Gate-source Threshold Voltage vs. Temperature

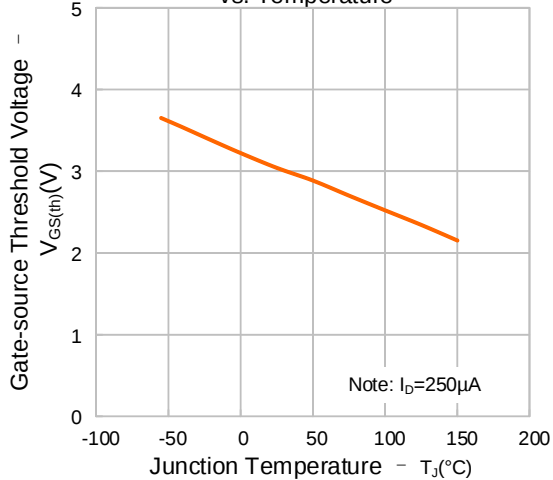


Figure 8. Body Diode Forward Voltage Variation vs. Source Current and Temperature

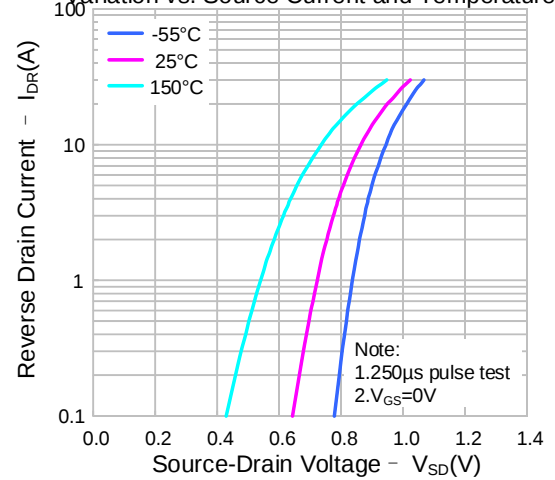


Figure 9. Capacitance Characteristics

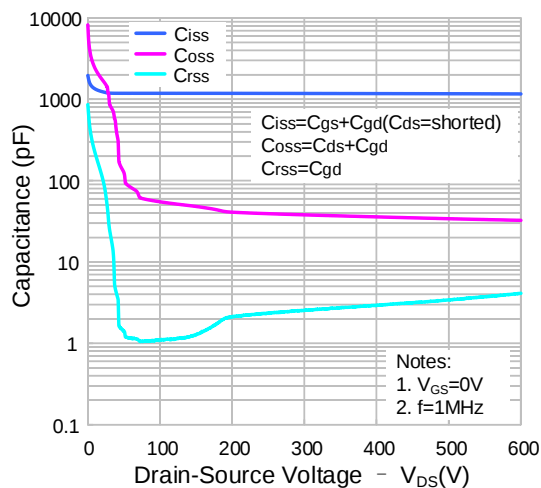


Figure 10. Gate Charge Characteristics

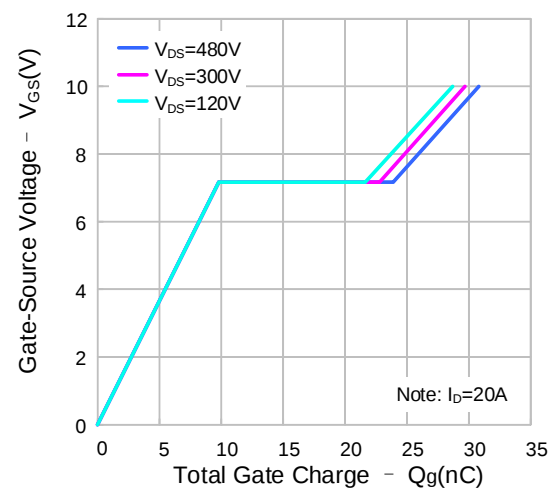


Figure 11. Breakdown Voltage Variation vs. Temperature

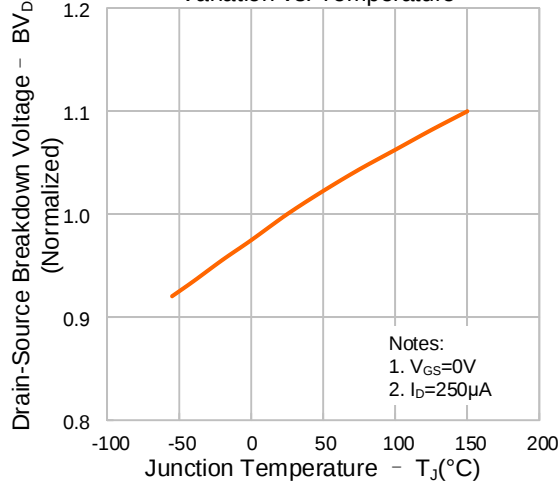
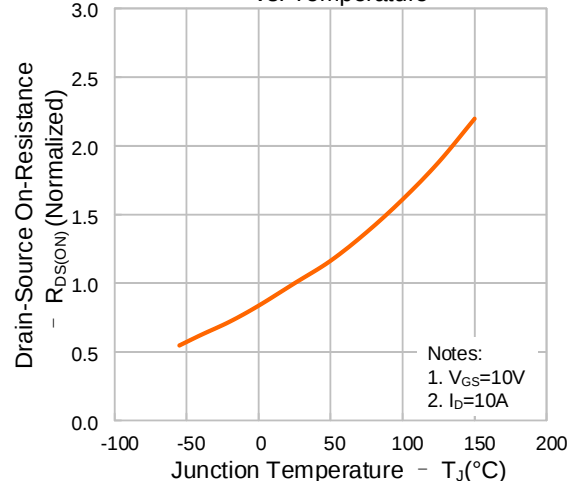
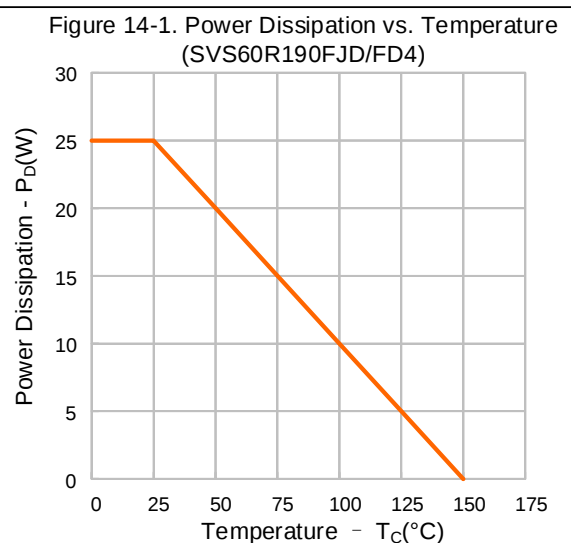
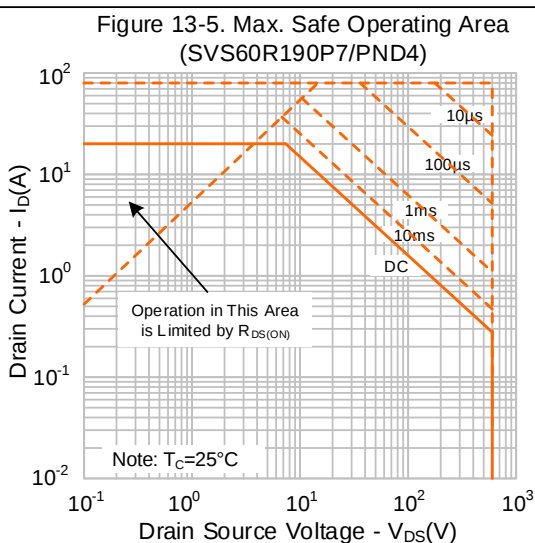
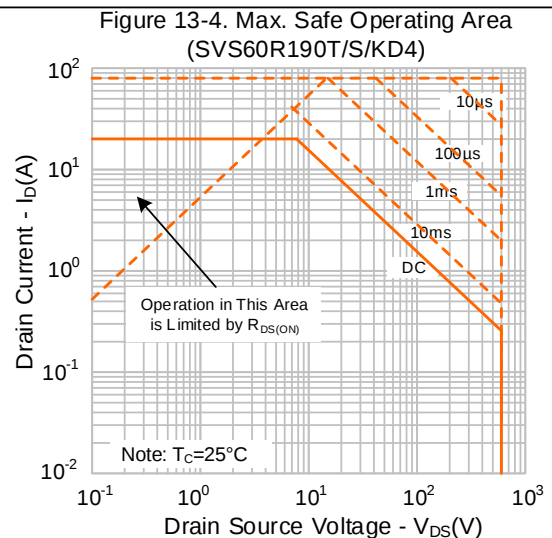
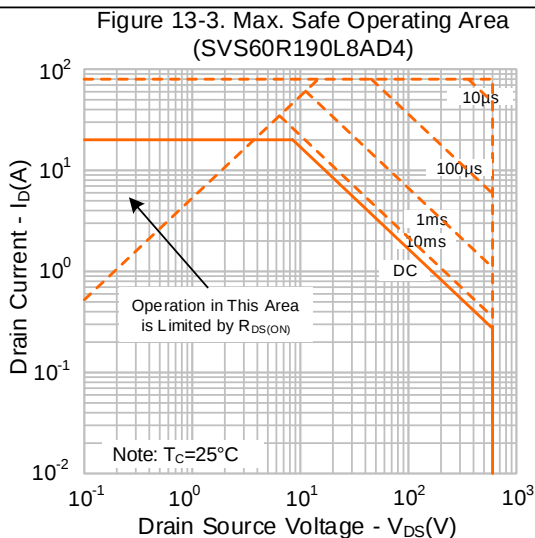
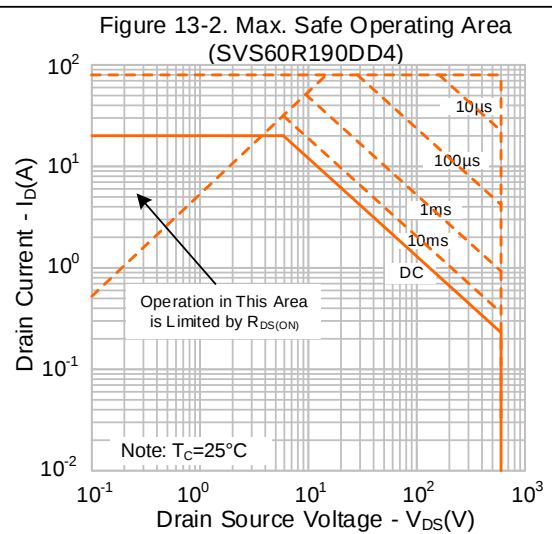
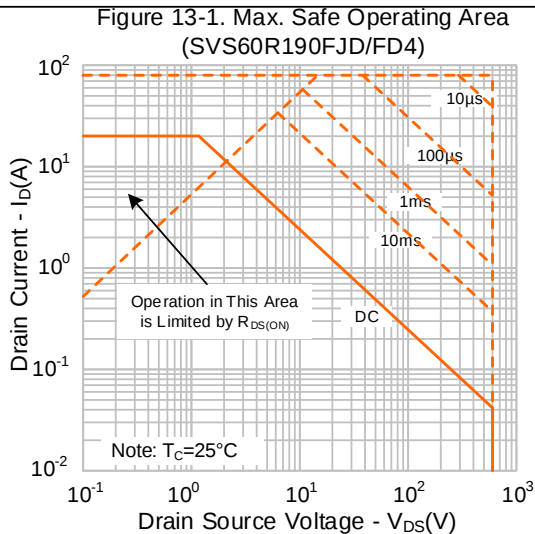


Figure 12. On-resistance Variation vs. Temperature



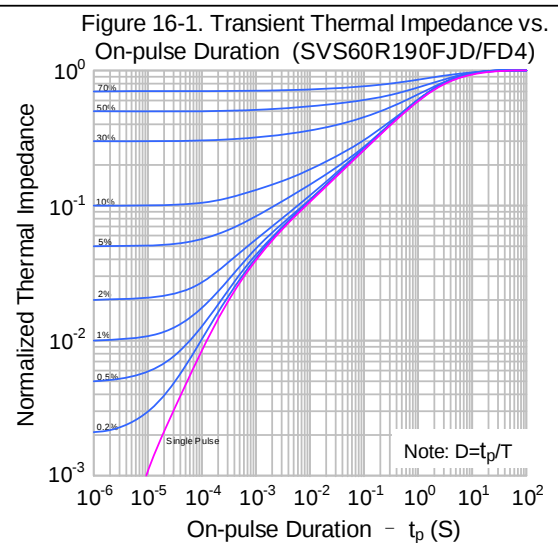
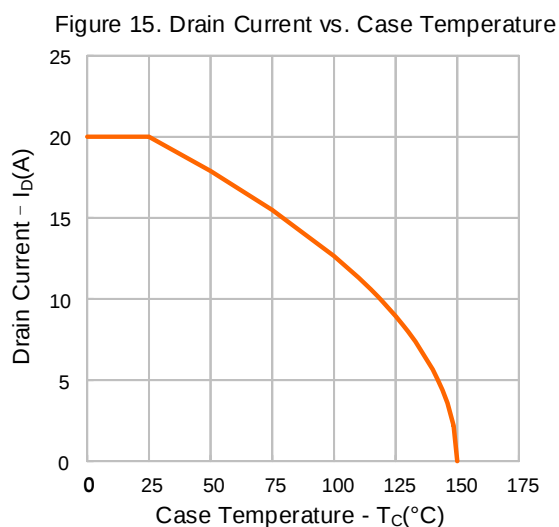
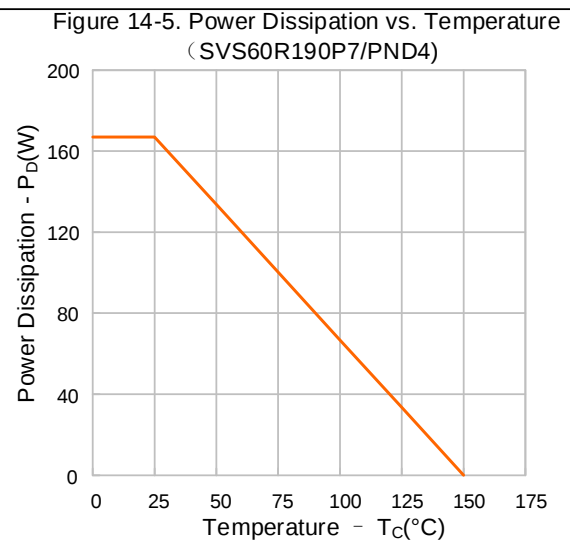
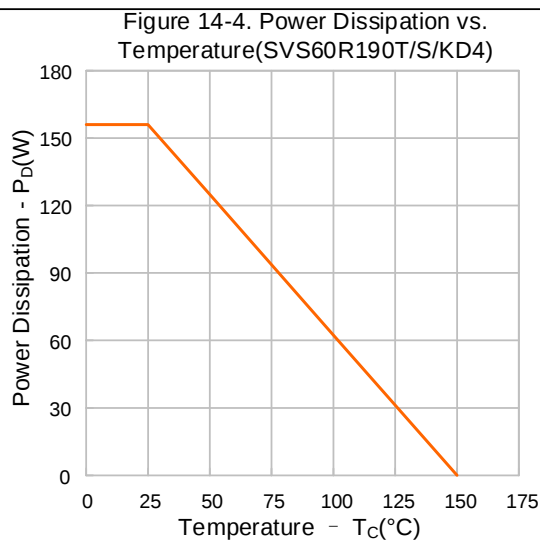
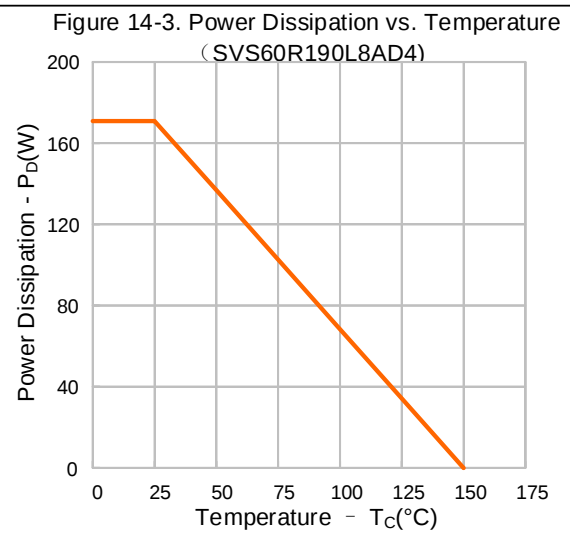
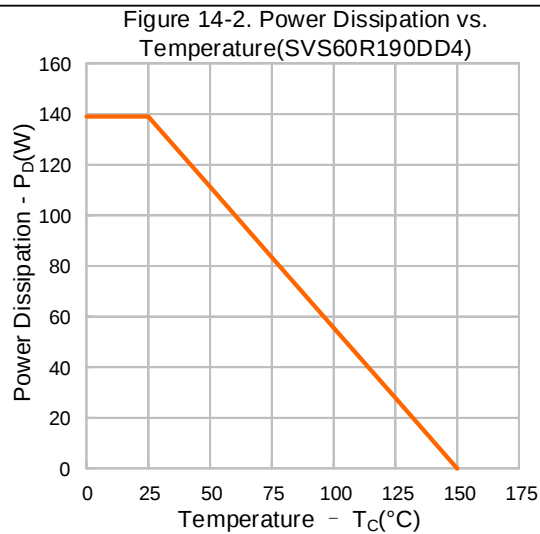


TYPICAL CHARACTERISTICS (CONTINUED)





TYPICAL CHARACTERISTICS (CONTINUED)





TYPICAL CHARACTERISTICS (CONTINUED)

Figure 16-2. Transient Thermal Impedance vs. On-pulse Duration (SVS60R190DD4)

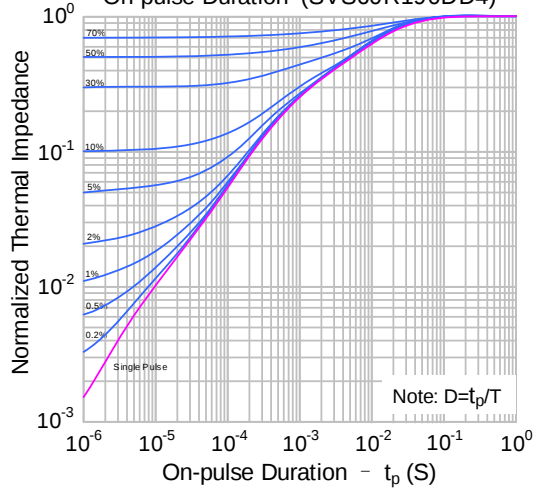


Figure 16-3. Transient Thermal Impedance vs. On-pulse Duration (SVS60R190L8AD4)

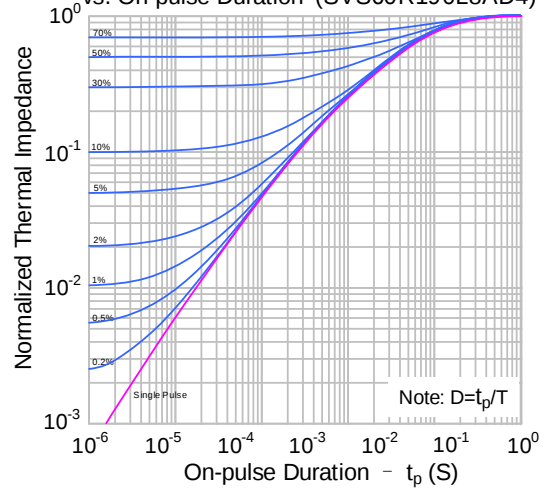


Figure 16-4. Transient Thermal Impedance vs. On-pulse Duration (SVS60R190T/S/KD4)

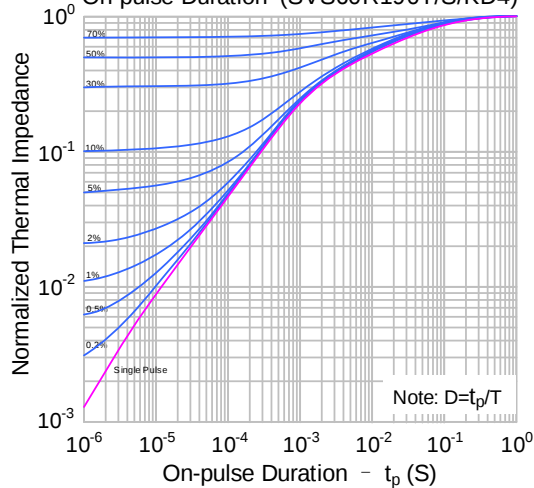
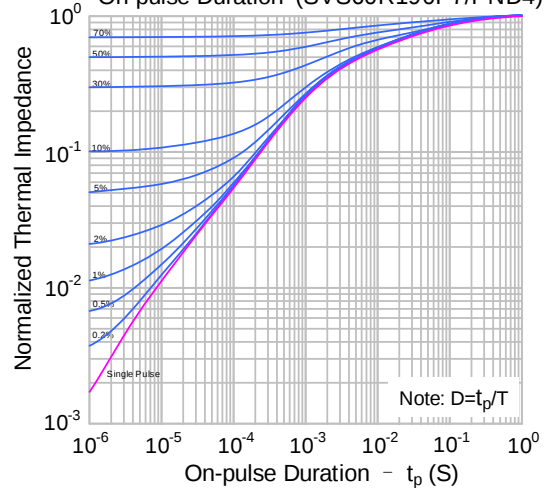


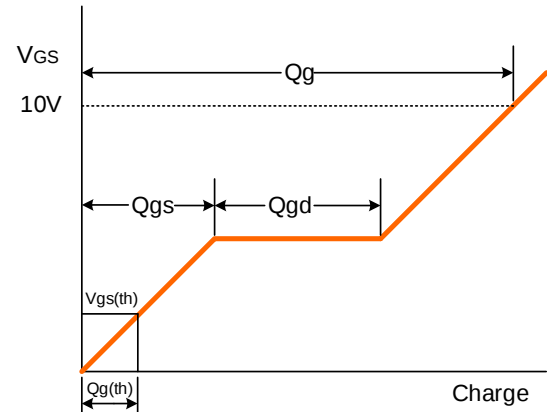
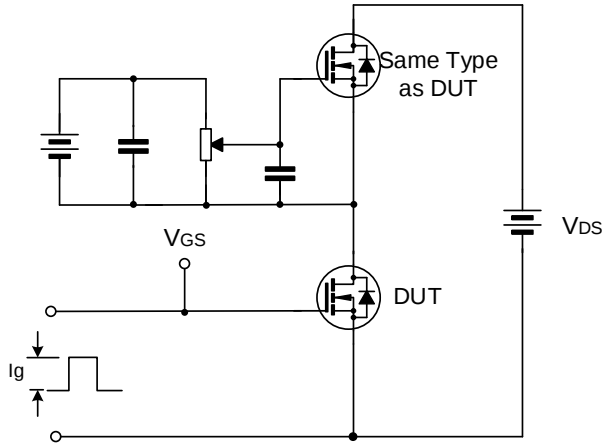
Figure 16-5. Transient Thermal Impedance vs. On-pulse Duration (SVS60R190P7/PND4)



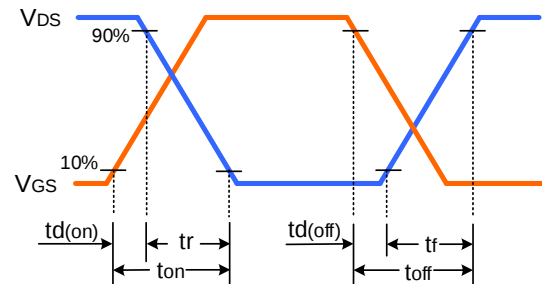
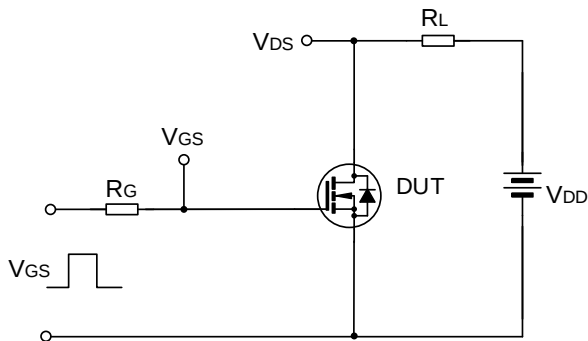


TYPICAL TEST CIRCUIT

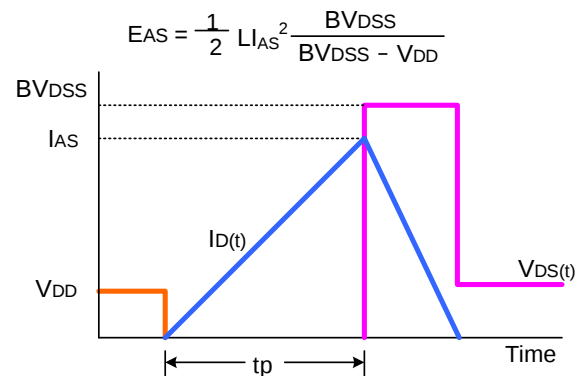
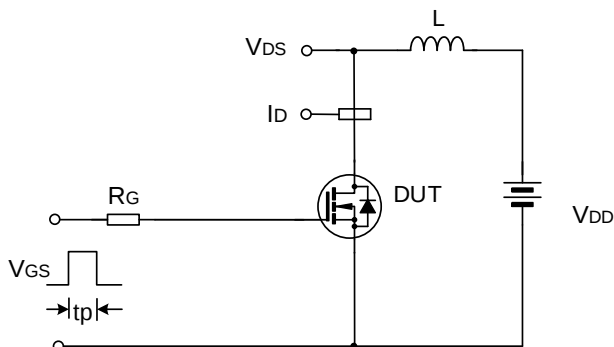
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveform

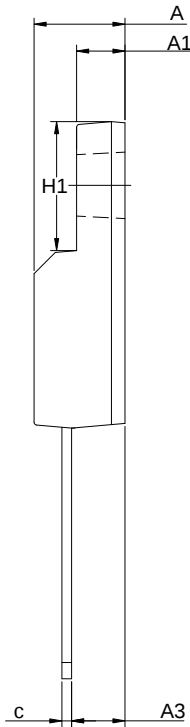
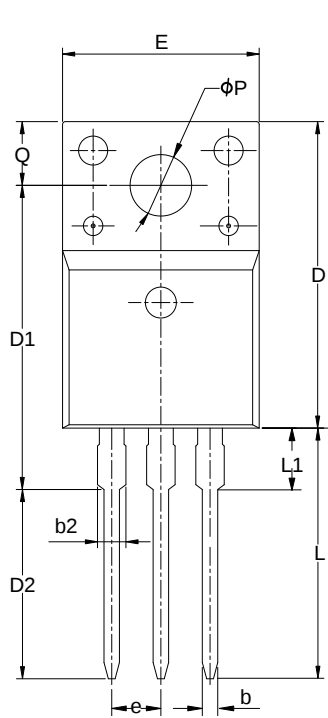




PACKAGE OUTLINE

TO-220FJD-3L

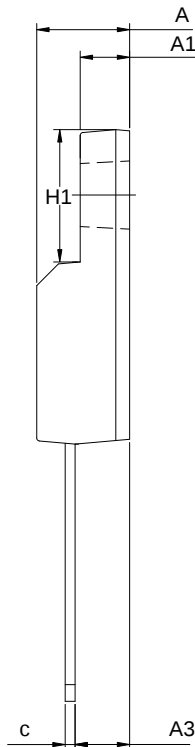
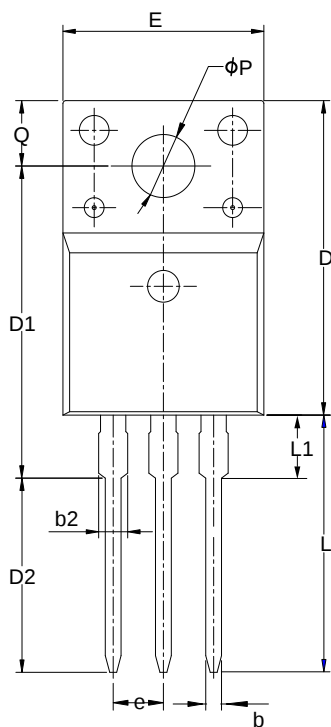
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SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.55	0.70	0.85
b2	—	—	1.29
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	13.97	14.47	14.97
D2	10.58	11.08	11.58
E	9.73	10.16	10.36
e	2.54BSC		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	—	—	2.00
φP	3.00	3.18	3.40
Q	3.05	3.30	3.55

TO-220F-3L

UNIT: mm



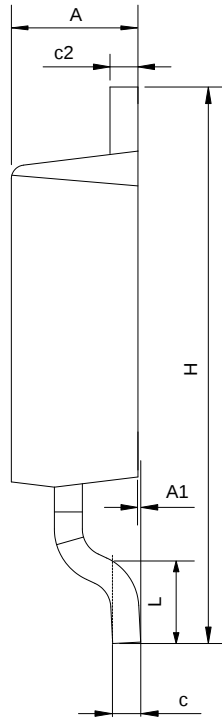
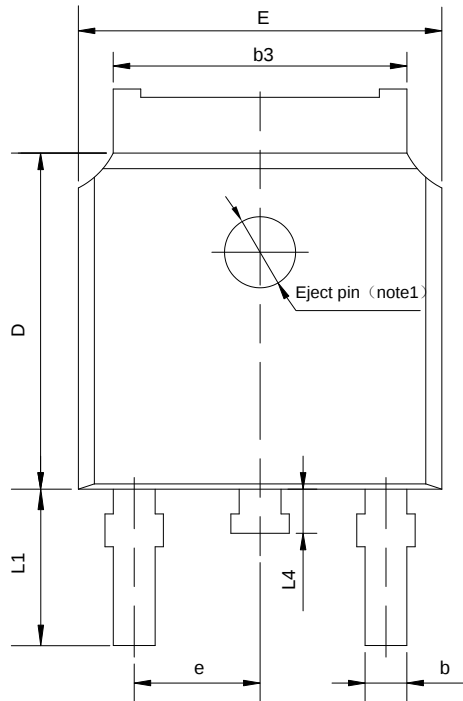
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.70	0.80	0.90
b2	—	—	1.47
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	15.30	15.75	16.30
D2	9.30	9.80	10.30
E	9.73	10.16	10.36
e	2.54BSC		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	—	—	3.50
φP	3.00	3.18	3.40
Q	3.05	3.30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



PACKAGE OUTLINE(CONTINUED)

TO-252-2L

UNIT: mm

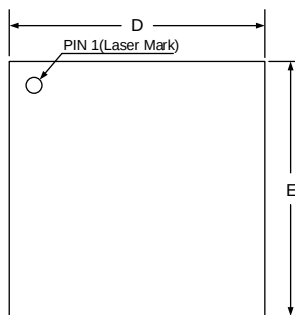


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	2.10	2.30	2.50
A1	0	—	0.127
b	0.66	0.76	0.89
b3	5.10	5.33	5.46
c	0.45	—	0.65
c2	0.45	—	0.65
D	5.80	6.10	6.40
E	6.30	6.60	6.90
e	2.30TYP		
H	9.60	10.10	10.60
L	1.40	1.50	1.70
L1	2.90REF		
L4	0.60	0.80	1.00

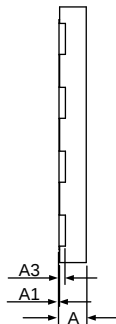
NOTE1 : There are two conditions for this position:has an eject pin or has no eject pin.

DFN-4-8x8x0.85-2.0

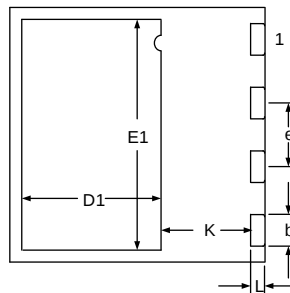
UNIT: mm



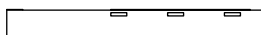
Top View



Side View



Bottom View



Side View

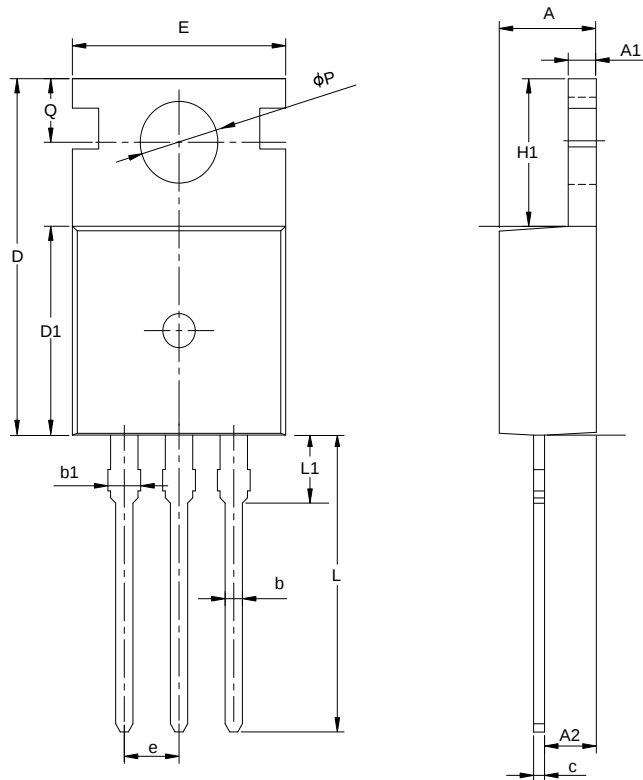
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.80	0.85	0.90
A1	0.00	0.02	0.05
A3	0.20 REF		
b	0.90	1.00	1.10
D	7.90	8.00	8.10
D1	4.25	4.35	4.45
E	7.90	8.00	8.10
E1	7.10	7.20	7.30
e	1.90	2.00	2.10
K	2.65	2.75	2.85
L	0.40	0.50	0.60



PACKAGE OUTLINE(CONTINUED)

TO-220-3L

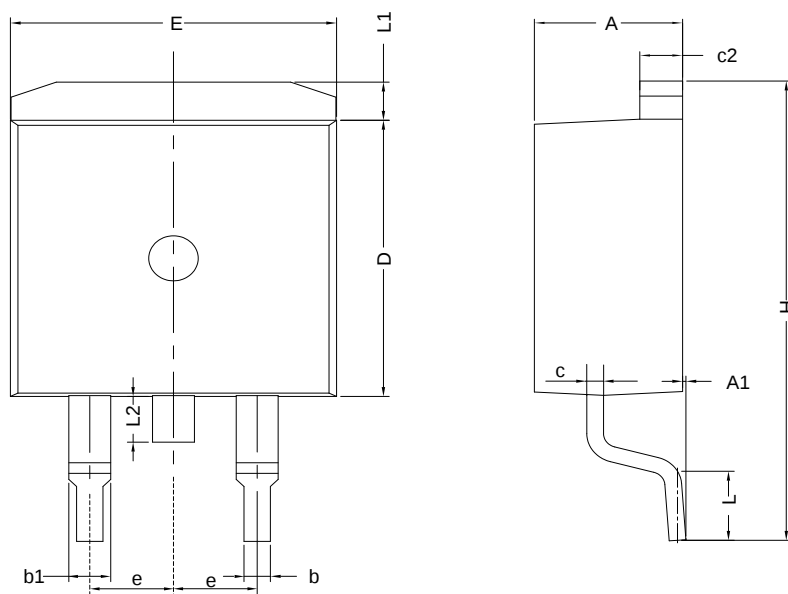
UNIT: mm



SYMBOL	MILLIMETER		
	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

TO-263-2L

UNIT: mm



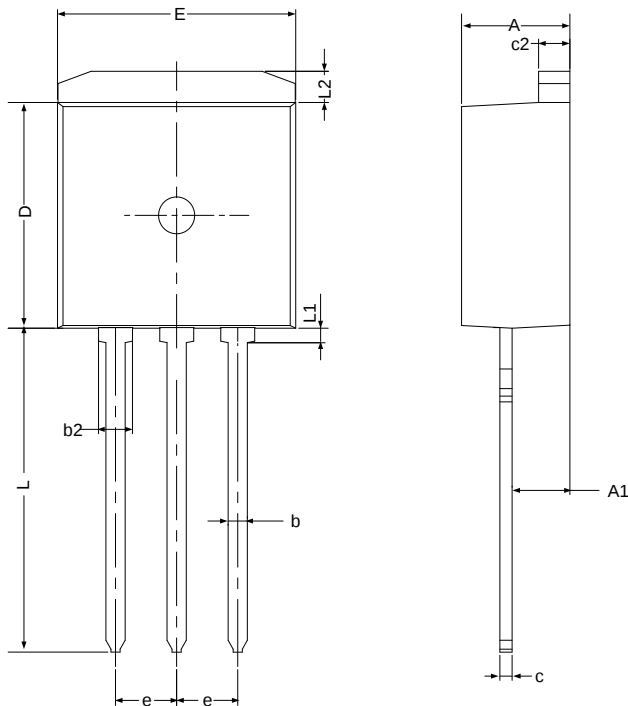
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.30	4.57	4.72
A1	0	0.10	0.25
b	0.71	0.81	0.91
b1	1.17	—	1.50
c	0.30	—	0.60
c2	1.17	1.27	1.37
D	8.50	—	9.35
E	9.80	—	10.45
e	2.54BSC		
H	14.70	—	15.75
L	2.00	2.30	2.74
L1	1.12	1.27	1.42
L2	—	—	1.75



PACKAGE OUTLINE(CONTINUED)

TO-262-3L

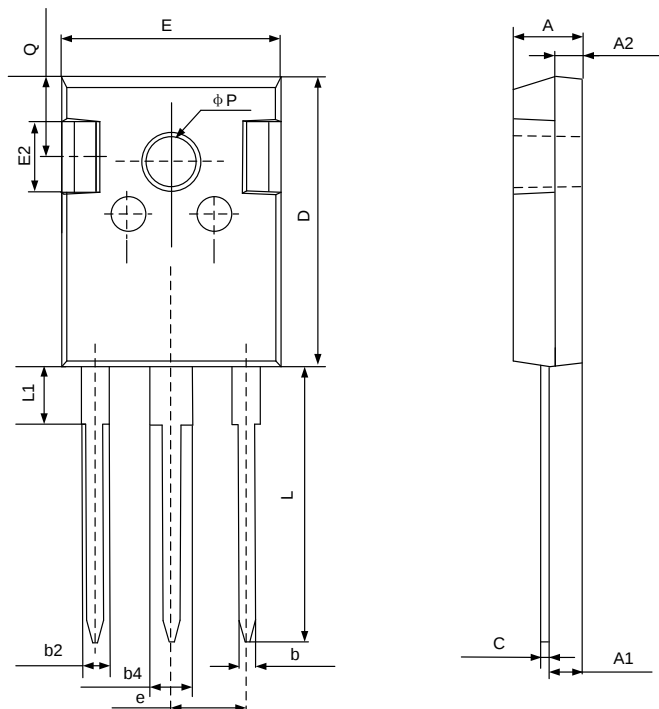
UNIT: mm



SYMBOL	MILLIMETER		
	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-247-3L

UNIT: mm



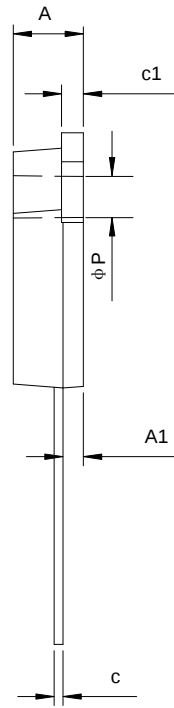
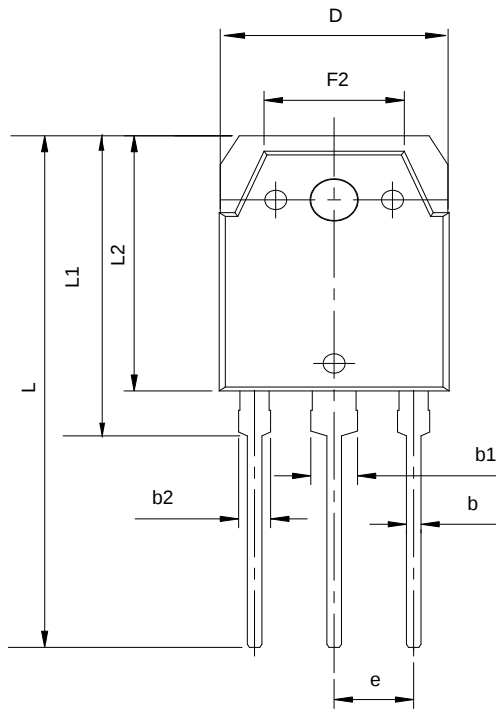
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	—	1.36
b2	1.91	—	2.25
b4	2.91	—	3.25
c	0.51	—	0.75
D	20.80	21.00	21.30
E	15.50	15.80	16.10
E2	4.40	5.00	5.20
e	5.44 BSC		
L	19.72	19.92	20.22
L1	—	—	4.30
Q	5.60	5.80	6.00
P	3.40	—	3.80



PACKAGE OUTLINE(CONTINUED)

TO-3P

UNIT: mm



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	4.4	—	5.2
c1	1.2	—	1.8
A1	1.2	—	2.0
b	0.7	1.0	1.3
b1	2.7	3.0	3.3
b2	1.7	2.0	2.3
D	15.0	15.5	16.0
c	0.4	0.6	0.8
F2	8.5	—	10.0
e	5.45 TYP		
L1	22.6	—	23.6
L	39.0	—	41.5
L2	19.5	—	21.0
P	3.0	—	3.4



MOS DEVICES OPERATE NOTES:

Electrostatic charges may exist in many things. Please take following preventive measures to prevent effectively the MOS electric circuit as a result of the damage which is caused by discharge:

- The operator must put on wrist strap which should be earthed to against electrostatic.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed in antistatic/conductive containers for transportation.



Important notice :

1. Silan reserves the right to make changes of this instruction without notice.
2. Customers should obtain the latest relevant information when purchasing and should verify whether such information is latest and complete. Please read this instruction and application manual and related materials carefully before using products, including the circuit operation precautions, etc.
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Rev.: 1.2

Revision History:

1. Add TO-220F-3L, TO-220-3L, TO-263-2L, TO-262-3L, TO-247-3L, TO-3P package
 2. Update the typical characteristic curve
-

Rev.: 1.1

Revision History:

1. Add DFN-4-8x8x0.85-2.0 package
 2. Update the typical characteristic curve
 3. Update important notice
-

Rev.: 1.0

Revision History:

1. First release
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