

## 14A, 650V SUPER JUNCTION MOS POWER TRANSISTOR

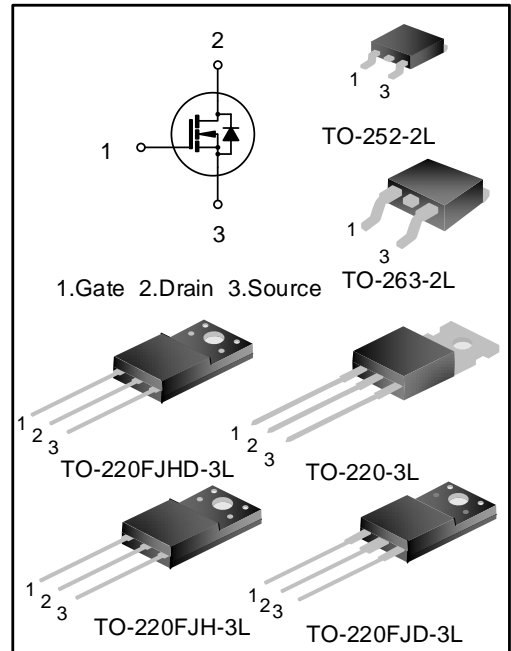
### DESCRIPTION

SVSP65R280FJD(FJH)(D)(T)(S)(FJHD)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

- ◆ 14A, 650V,  $R_{DS(on)}(typ.)=0.24\Omega@V_{GS}=10V$
- ◆ 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
$V_{DS}@T_{J,max}$	700	V
$V_{GS(th)}$	2.5~4.5	V
$R_{DS(on),max}$	0.28	$\Omega$
$I_{D,pulse}$	56	A
$Q_g,typ.$	26	nC

### ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing Type
SVSP65R280FJDD4	TO-220FJD-3L	P65R280D4	Halogen free	Tube
SVSP65R280FJHD4	TO-220FJH-3L	P65R280D4	Halogen free	Tube
SVSP65R280DD4TR	TO-252-2L	P65280D4	Halogen free	Tape & Reel
SVSP65R280TD4	TO-220-3L	P65R280D4	Halogen free	Tube
SVSP65R280SD4	TO-263-2L	P65R280D4	Halogen free	Tube
SVSP65R280SD4TR	TO-263-2L	P65R280D4	Halogen free	Tape & Reel
SVSP65R280FJHDD4	TO-220FJHD-3L	P65R280D4	Halogen free	Tube

**ABSOLUTE MAXIMUM RATINGS (UNLESS OTHERWISE NOTED,  $T_J=25^\circ\text{C}$ )**

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Gate-source Voltage (Static)	$V_{GS}$	--	-20	--	20	V
Gate-source Voltage (Dynamic)	$V_{GS}$	AC( $f>1\text{Hz}$ )	-30	--	30	V
Drain Current	$I_D$	$T_C=25^\circ\text{C}$	--	--	14	A
		$T_C=100^\circ\text{C}$	--	--	8.8	A
Drain Current Pulsed (Note 1)	$I_{DM}$	$T_C=25^\circ\text{C}$	--	--	56	A
Power Dissipation (TO-220FJD-3L) (TO-220FJH-3L) (TO-220FJHD-3L) (Note 2)	$P_D$	$T_C=25^\circ\text{C}$	--	--	24	W
Power Dissipation (TO-252-2L) (Note 2)	$P_D$	$T_C=25^\circ\text{C}$	--	--	109	W
Power Dissipation (TO-220-3L) (TO-263-2L) (Note 2)	$P_D$	$T_C=25^\circ\text{C}$	--	--	133	W
Single Pulsed Avalanche Energy	$E_{AS}$	$L=79\text{mH}$ , $V_{DD}=100\text{V}$ , $R_G=25\Omega$ , starting temperature $T_J=25^\circ\text{C}$	--	--	307	mJ
Single Pulsed Current	$I_{AS}$	--	--	--	2.6	A
Reverse Diode dv/dt	dv/dt	$V_{DS}=0\sim 400\text{V}$ , $I_{SD}\leq I_S$ , $T_J=25^\circ\text{C}$	--	--	15	V/ns
MOSFET dv/dt Ruggedness	dv/dt	$V_{DS}=0\sim 480\text{V}$	--	--	50	V/ns
Operation Junction Temperature Range	$T_J$	--	-55	--	150	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	--	-55	--	150	$^\circ\text{C}$
Continuous Diode Forward Current	$I_S$	$T_C=25^\circ\text{C}$ , integral reverse P-N junction diode in the MOSFET	--	--	14	A
Diode Pulse Current	$I_{S,pulse}$		--	--	56	A
Maximum Diode Commutation Speed	di/dt	$V_{DS}=0\sim 400\text{V}$ , $I_{SD}\leq I_S$ , $T_J=25^\circ\text{C}$	--	--	500	A/ $\mu\text{s}$

**THERMAL CHARACTERISTICS**

Table1. TO-220FJD-3L/ TO-220FJH-3L/TO-220FJHD-3L (SVSP65R280FJD/FJH/FJHDD4)

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	5.2	°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

Table 2. TO-252-2L (SVSP65R280DD4)

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	1.15	°C/W
Thermal Resistance, Junction-ambient	$R_{\theta JA}$	--	--	--	62.0	°C/W
Soldering Temperature (SMD)	$T_{sold}$	Reflow soldering: $10 \pm 1$ sec, 3times	--	--	260	°C

Table 3. TO-220-3L (SVS65R280TD4) thermal characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	0.94	°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

Table 4. TO-263-2L (SVS65R280SD4) thermal characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	0.94	°C/W
Thermal Resistance, Junction-ambient	$R_{\theta JA}$	--	--	--	62.5	°C/W
Soldering Temperature (SMD)	$T_{sold}$	Reflow soldering: $10 \pm 1$ sec, 3times	--	--	260	°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	$V_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	650	--	--	V
Drain-source Leakage Current	$I_{DSS}$	$V_{DS}=650V, V_{GS}=0V, T_J=25^{\circ}\text{C}$	--	--	1.0	$\mu A$
		$V_{DS}=650V, V_{GS}=0V, T_J=125^{\circ}\text{C}$	--	1.0	--	
Gate-source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	--	--	$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	2.5	--	4.5	V
Static Drain-source On State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=7.0A, T_J=25^{\circ}\text{C}$	--	0.24	0.28	$\Omega$
		$V_{GS}=10V, I_D=7.0A, T_J=150^{\circ}\text{C}$	--	0.55	--	
Gate Resistance	$R_G$	$f=1\text{MHz}$	--	3.0	--	$\Omega$

**Dynamic characteristics**

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Input Capacitance	$C_{iss}$	$f=1\text{MHz}, V_{GS}=0V, V_{DS}=100V$	--	920	--	pF
Output Capacitance	$C_{oss}$		--	41	--	
Reverse Transfer Capacitance	$C_{rss}$		--	1.0	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=325V, V_{GS}=10V,$ $R_G=24\Omega, I_D=14A$ (Notes 3, 4)	--	19	--	ns
Turn-on Rise Time	$t_r$		--	44	--	
Turn-off Delay Time	$t_{d(off)}$		--	68	--	
Turn-off Fall Time	$t_f$		--	36	--	
Total Gate Charge	$Q_g$	$V_{DD}=520V, V_{GS}=10V, I_D=14A$ (Notes 3, 4)	--	26	--	nC
Gate-source Charge	$Q_{gs}$		--	7.2	--	
Gate-drain Charge	$Q_{gd}$		--	12	--	
Gate-plateau Voltage	$V_{plateau}$		--	6.8	--	V

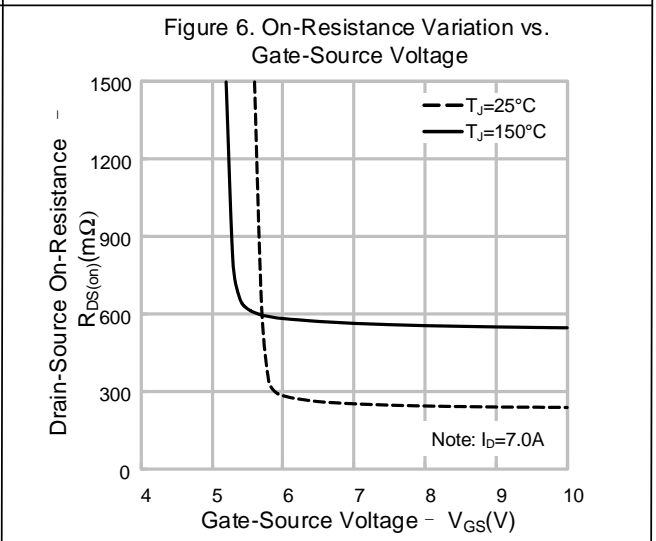
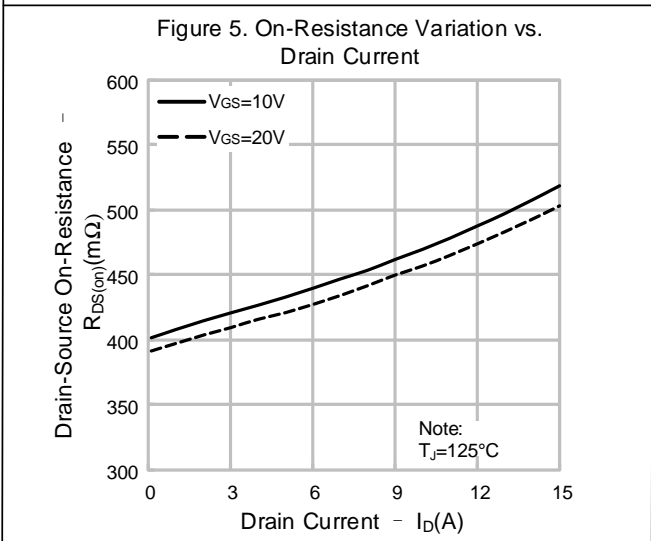
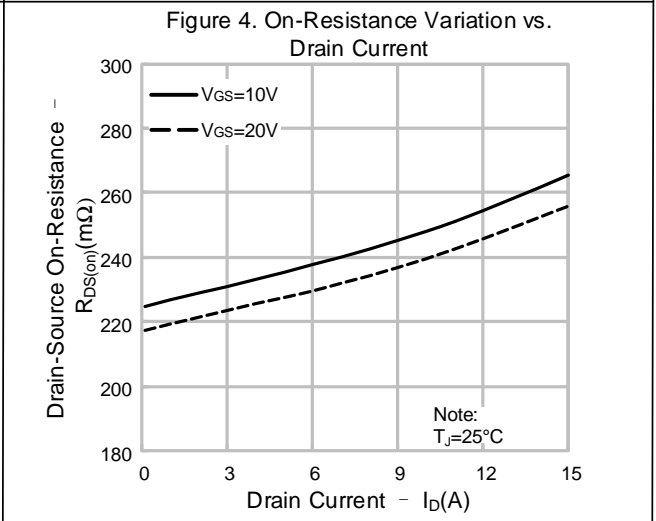
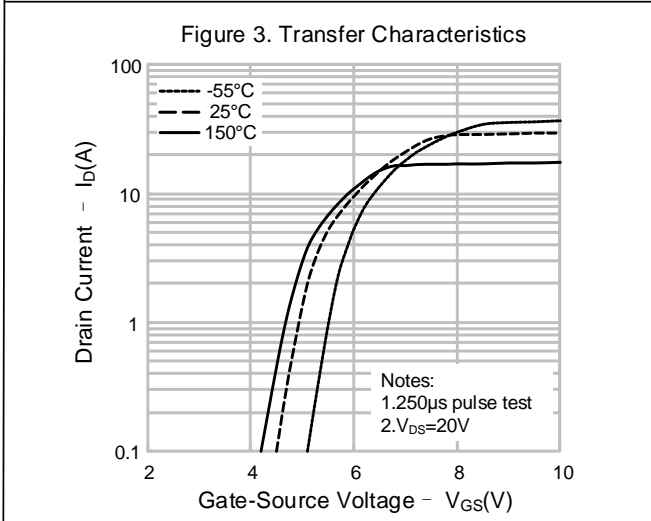
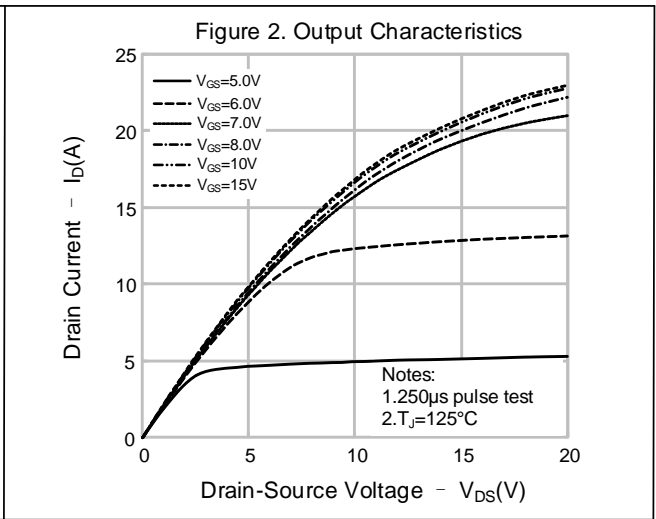
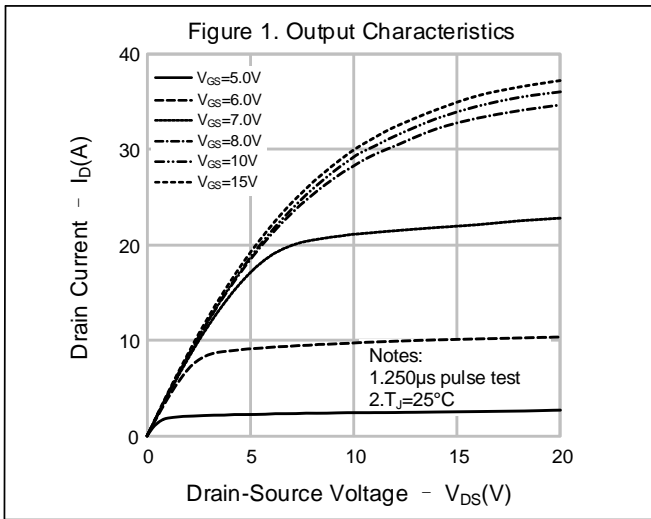
**Reverse diode characteristics**

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	$V_{SD}$	$I_S=14A, V_{GS}=0V$	--	--	1.4	V
Reverse Recovery Time	$T_{rr}$	$I_S=14A, V_{GS}=0V, V_R=50V,$ $di_F/dt=100A/\mu s$ (Note 3)	--	266	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	3.4	--	$\mu C$
Reverse Recovery Peak Current	$I_{rrm}$		--	26	--	A

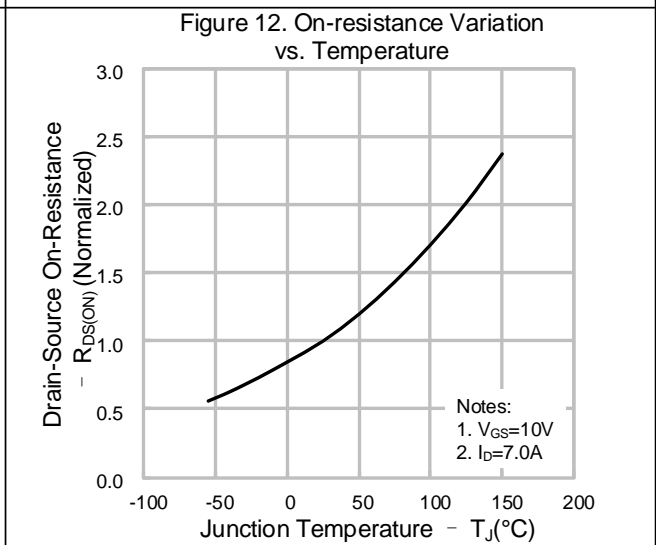
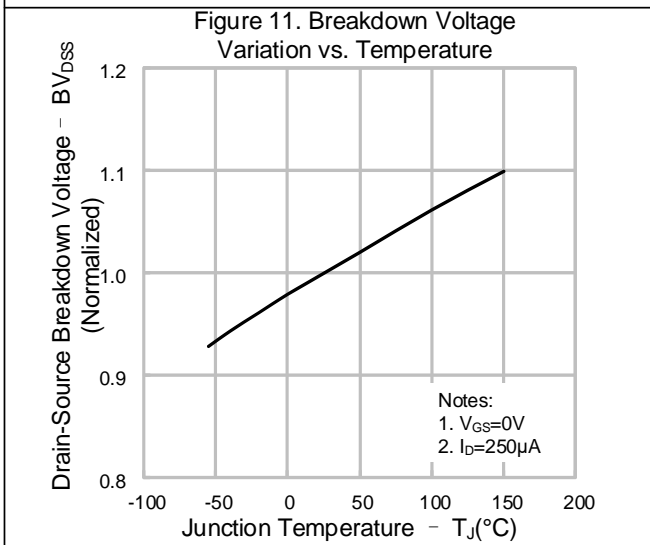
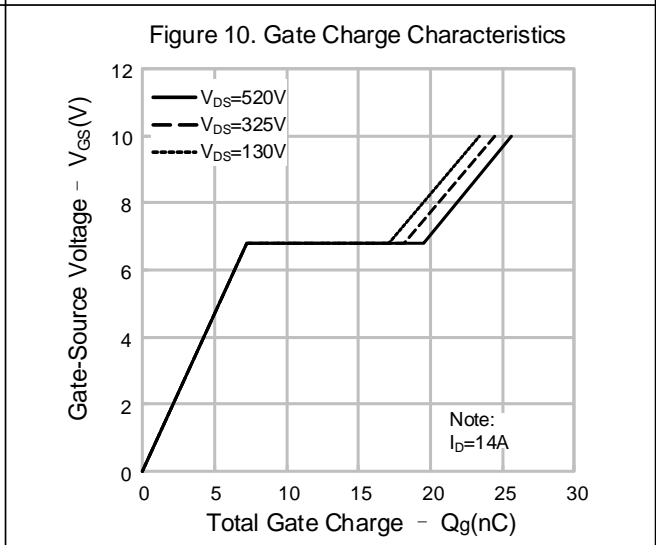
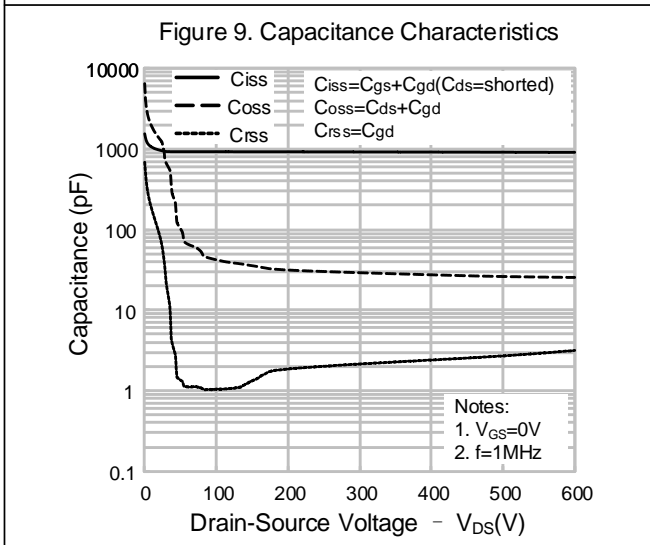
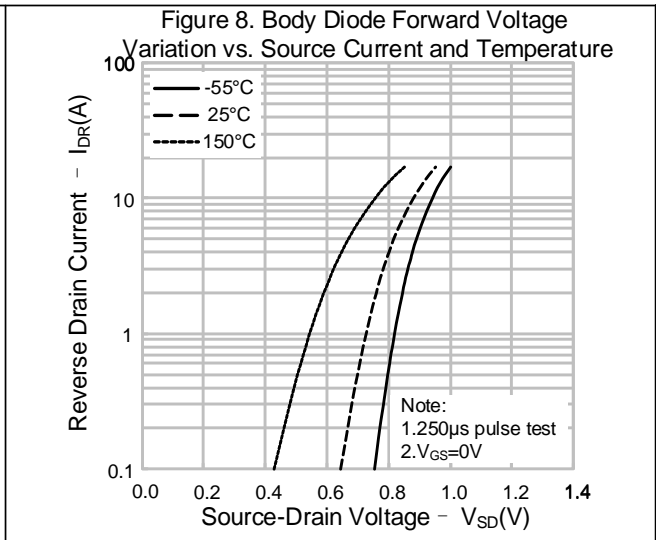
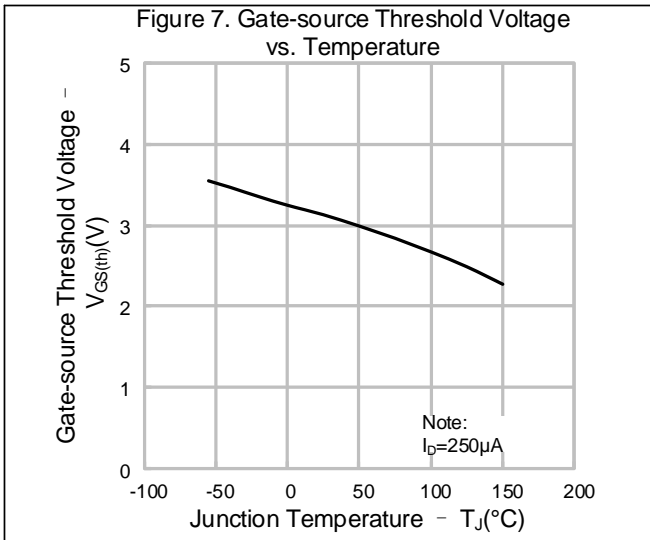
**Notes:**

- Pulse time  $5\mu s$ ;
- The dissipation power will change with temperature, derating above  $25^{\circ}\text{C}$ :  $.20W/^{\circ}\text{C}(\text{TO-220FJD-3L})(\text{TO-220FJH-3L})(\text{TO-220FJHD-3L})/0.87W/^{\circ}\text{C}(\text{TO-252-2L})/1.06W/^{\circ}\text{C}(\text{TO-220-3L})(\text{TO-263-2L})$ ;
- Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ ;
- Essentially independent of operating temperature.

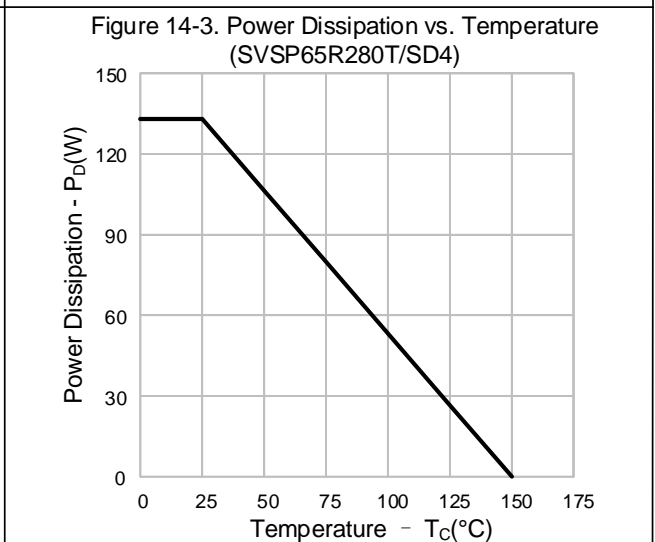
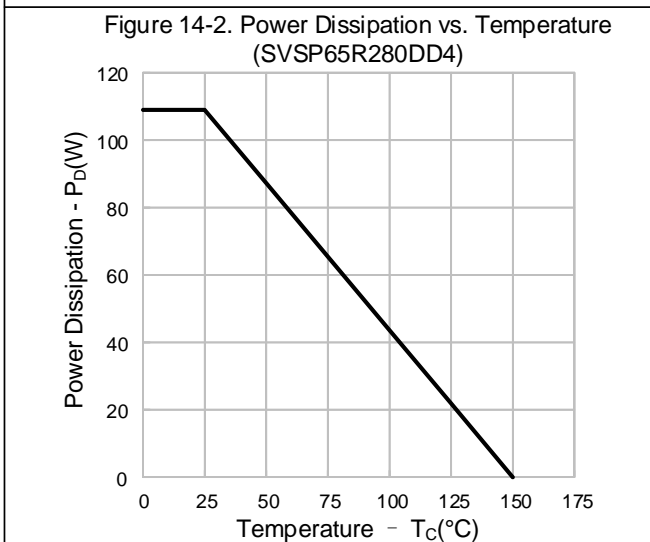
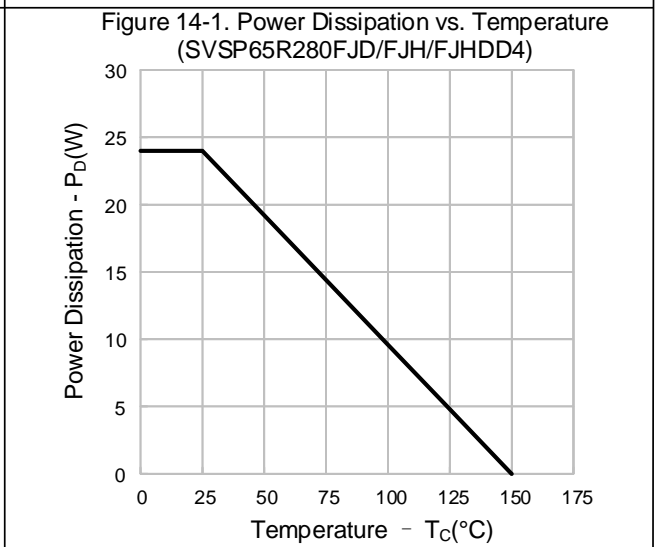
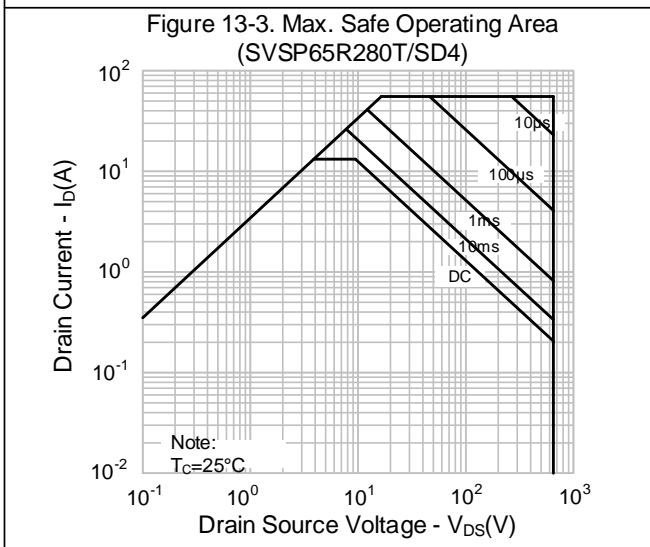
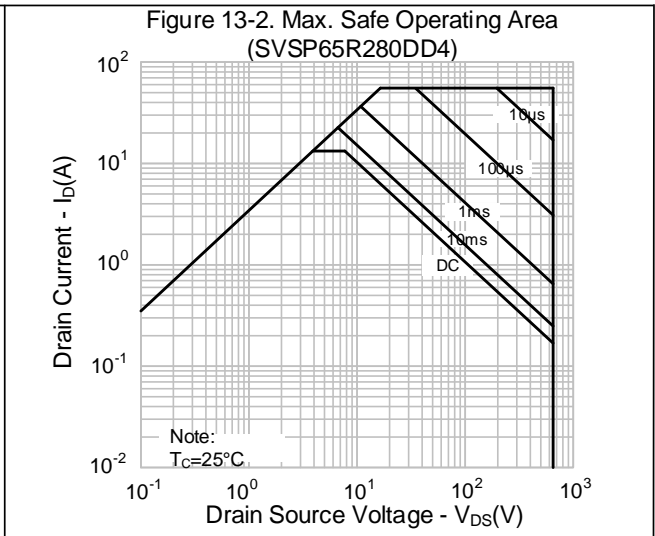
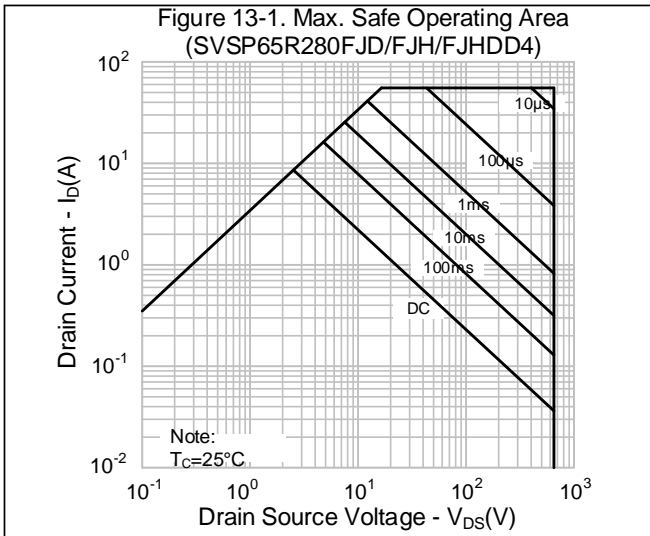
TYPICAL CHARACTERISTICS



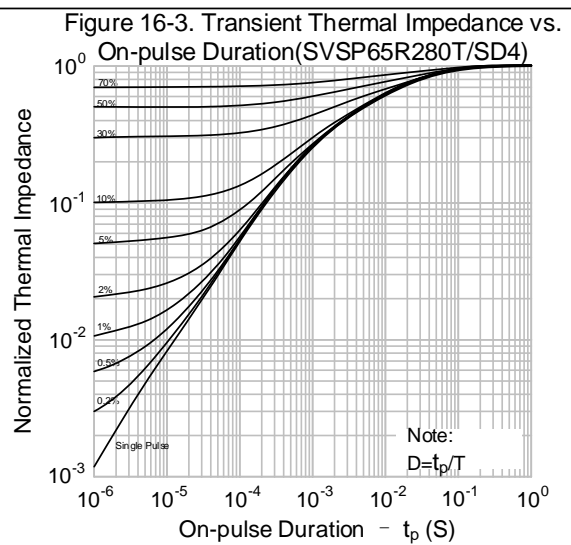
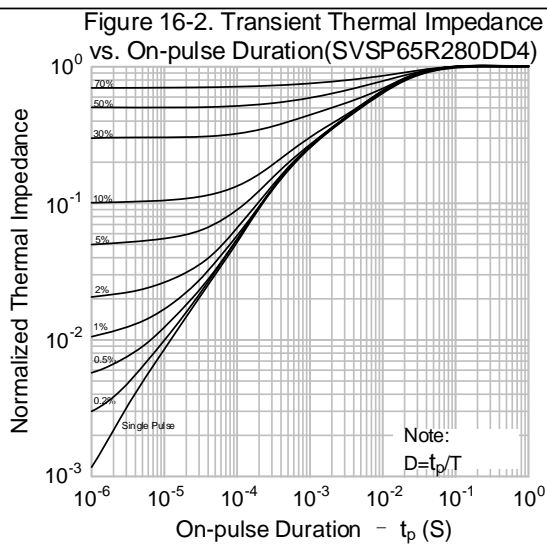
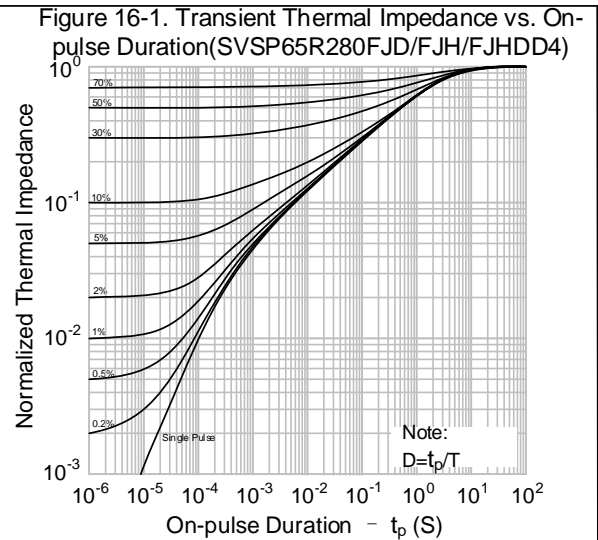
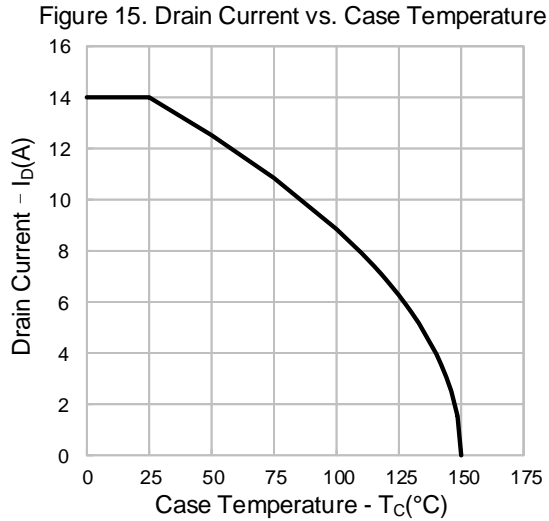
TYPICAL CHARACTERISTICS (CONTINUED)



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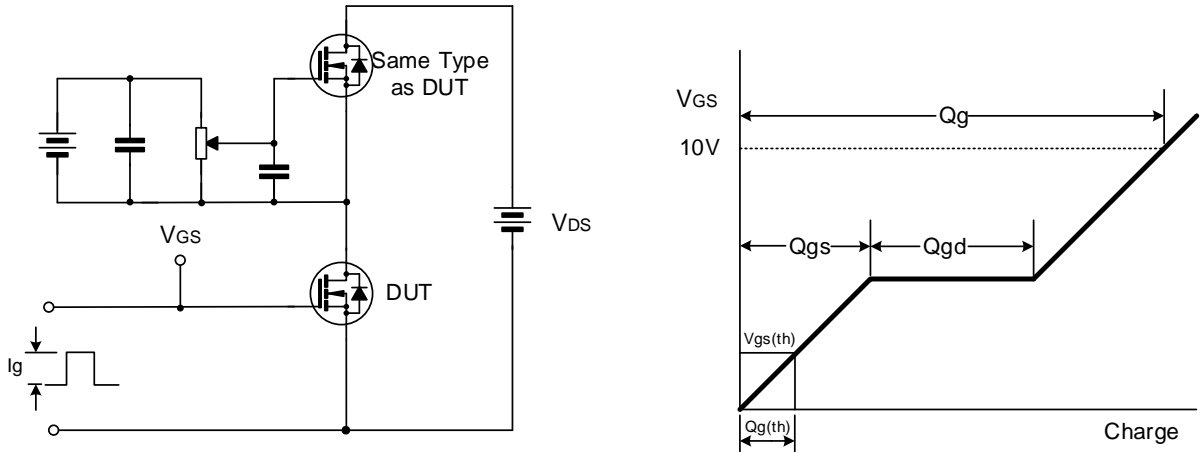
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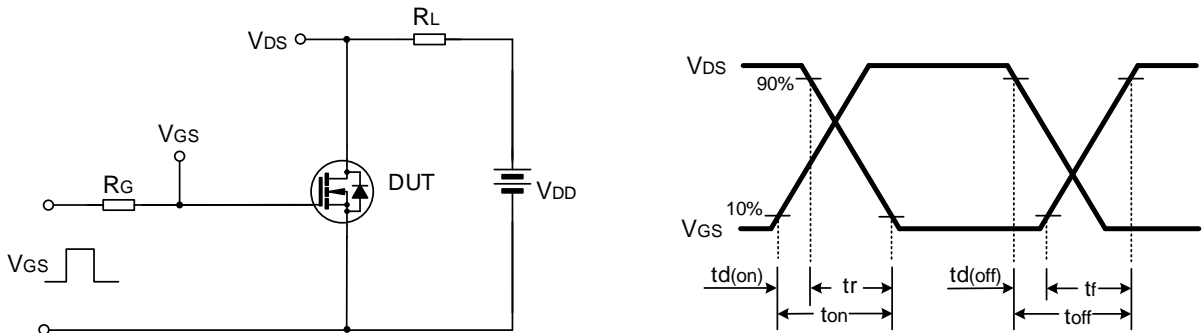


TYPICAL TEST CIRCUIT

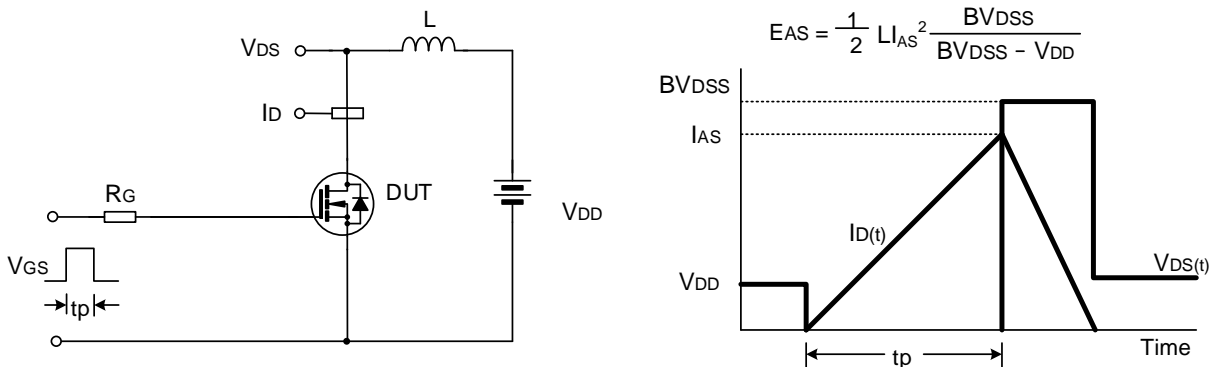
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform

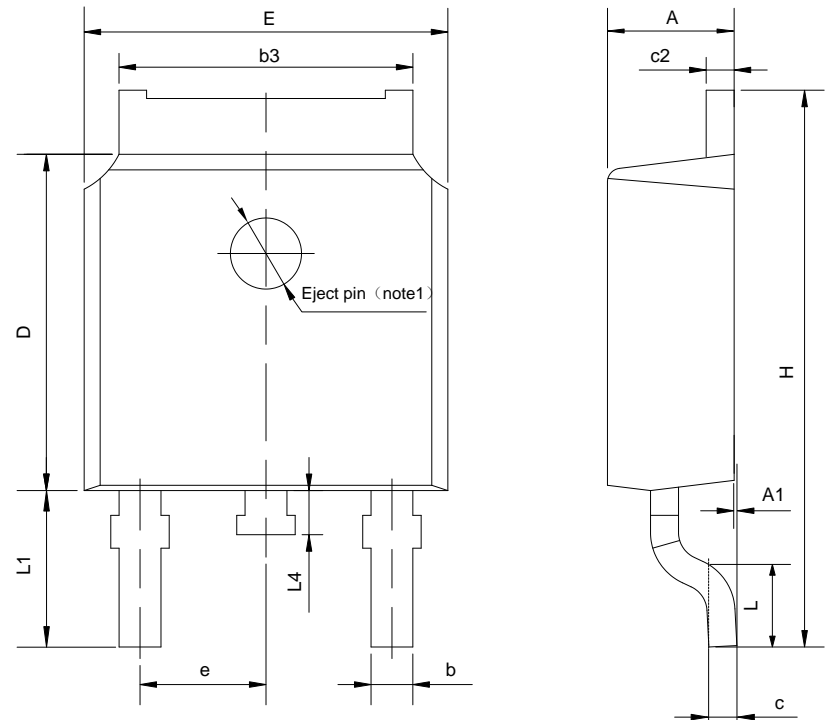


Unclamped Inductive Switching Test Circuit & Waveform



PACKAGE OUTLINE

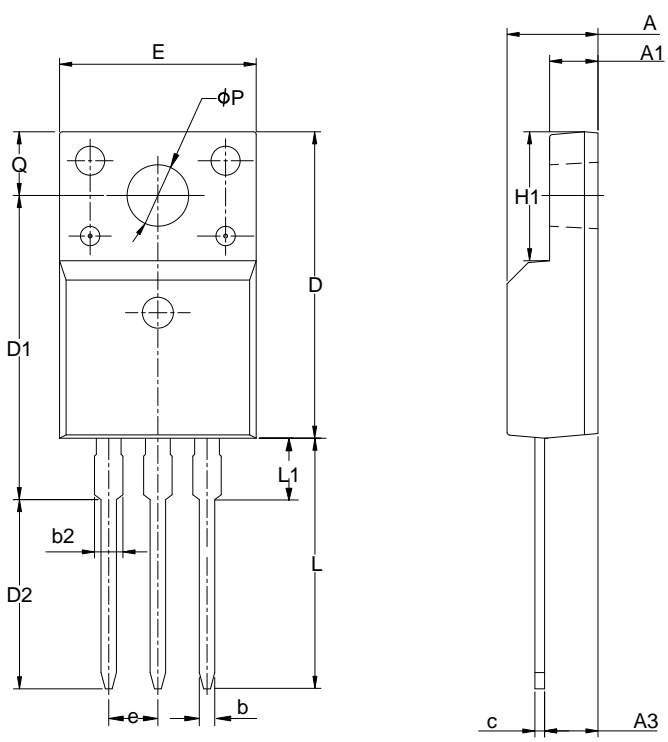
**TO-252-2L** **UNIT: mm**



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

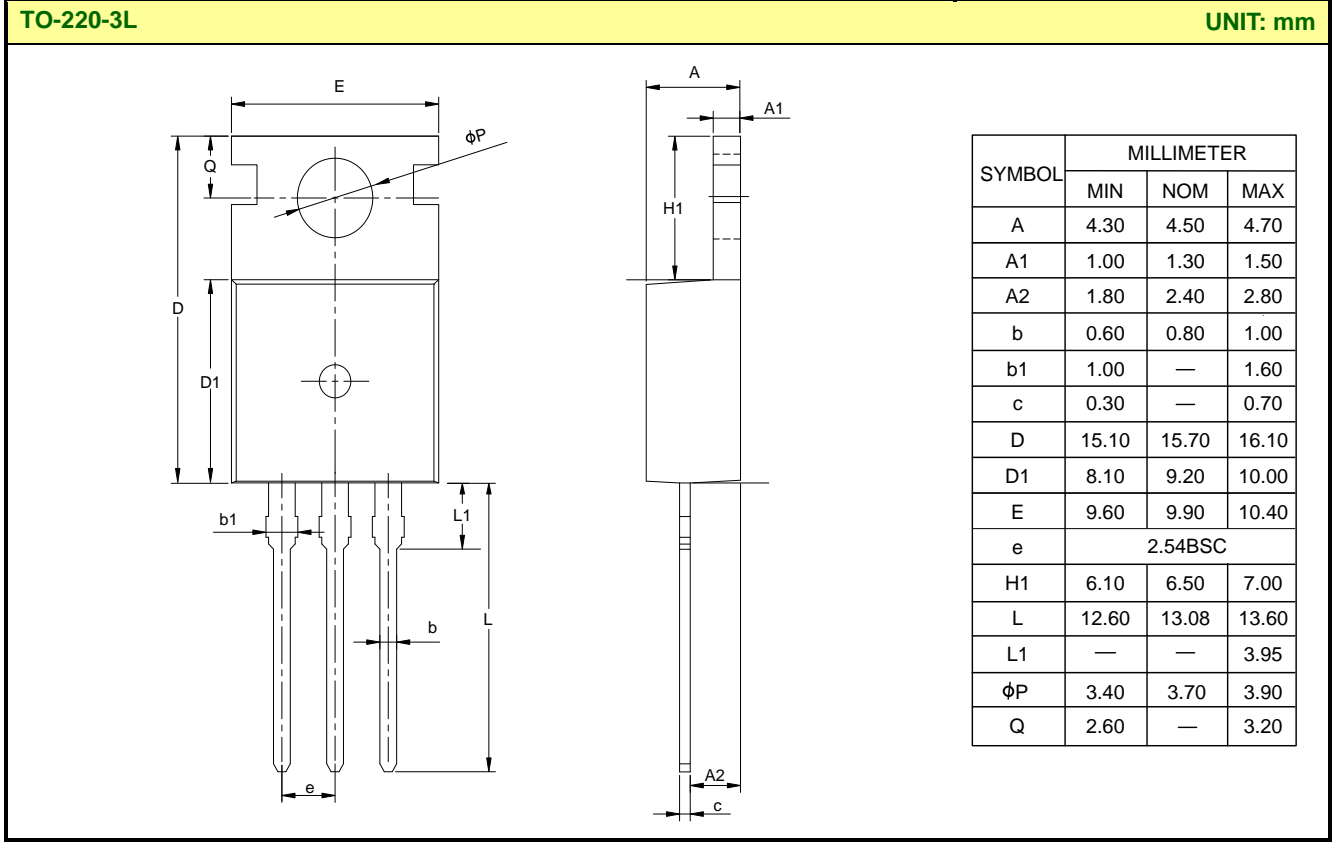
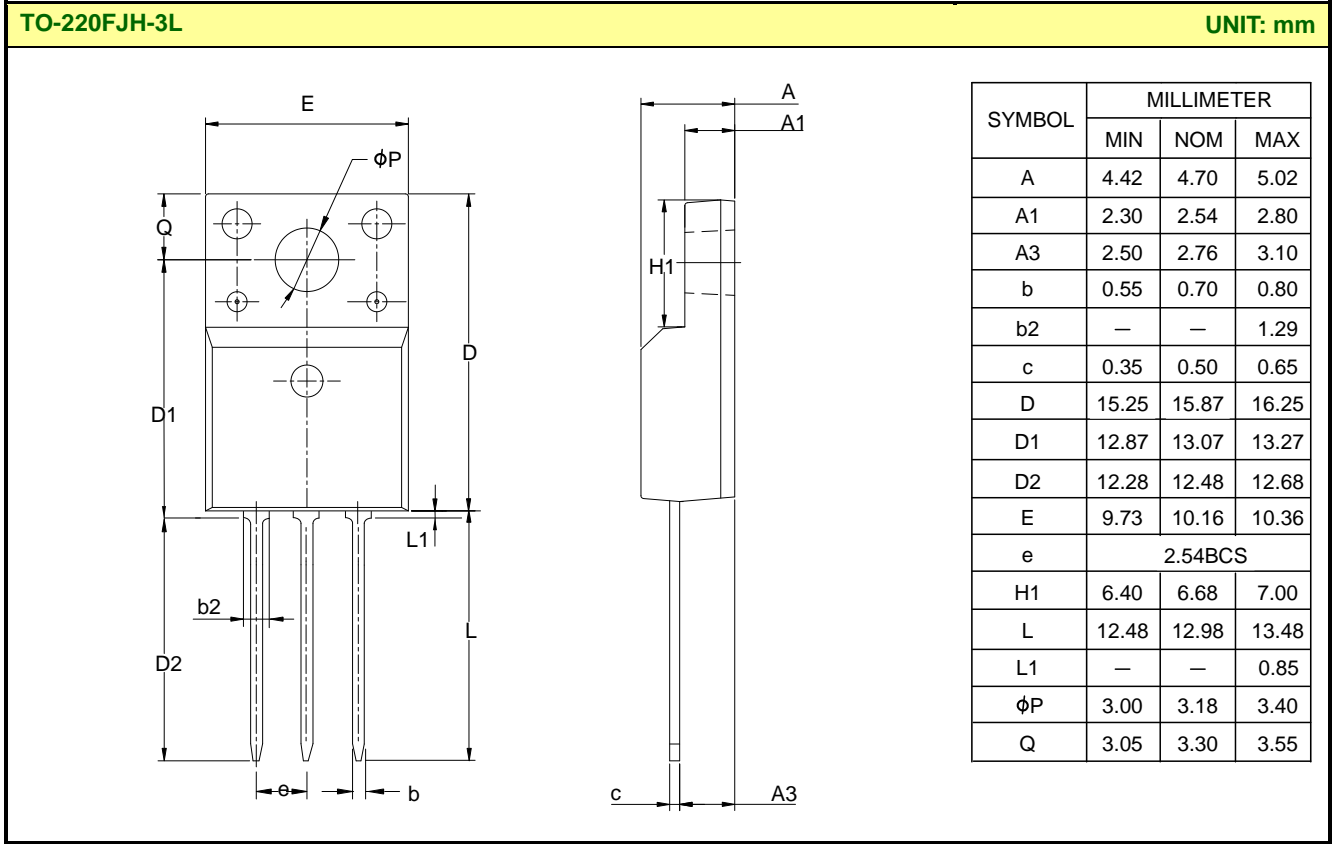
**NOTE1** : There are two conditions for this position:has an eject pin or has no eject pin.

**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

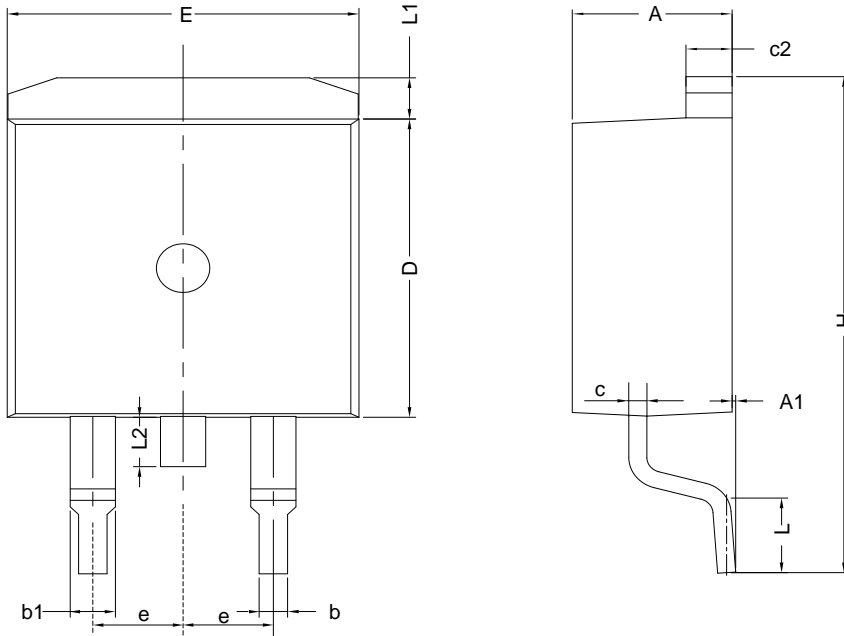
PACKAGE OUTLINE(CONTINUED)



PACKAGE OUTLINE(CONTINUED)

TO-263-2L

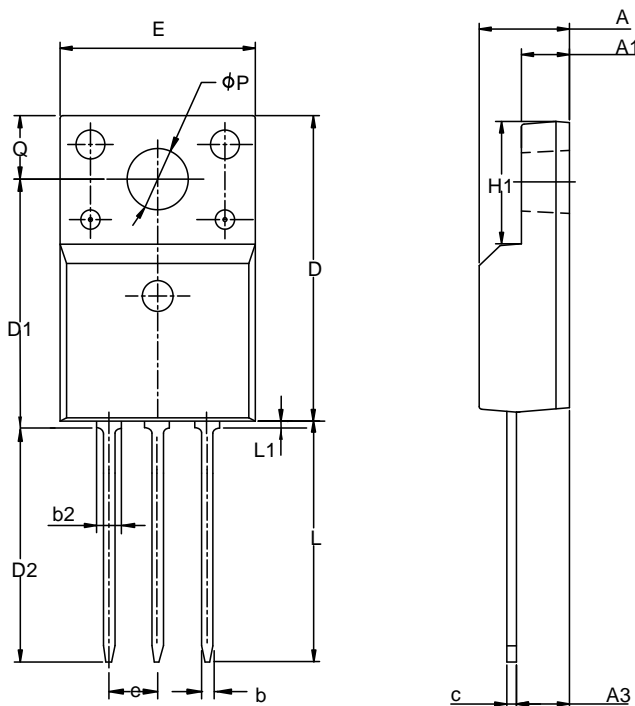
UNIT: mm



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

TO-220FJHD-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	2.54BSC		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	—	—	0.85
$\phi P$	3.00	3.18	3.40
Q	3.05	3.30	3.55



**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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4. The application of the product described in this instruction, the application manual of the product and related materials is for illustrative purposes only, and Silan makes no warranty that such application can be used directly without further testing, verification or modification. Silan is not responsible for any assistance in product application or customers' product design. Customer shall be responsible for the application of Silan's products and the design, manufacture and use of customers' products using Silan's products (in this document, "use products", "apply Silan's products", "product application" and "customers' products using Silan's products" are synonymous). It is the sole responsibility of the customer to take the following actions: 1) Verify and determine whether Silan's products are suitable for the customers' applications and customers' products; 2) All applicable standards of the customers' industry shall be complied with and fully tested and verified when applying Silan's product or using Silan's product to develop and design customers' products; 3) Although Silan is constantly committed to improve product's quality and reliability, semiconductor products have possibility to malfunction or fail in various application environments. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for customers' products using Silan's product to minimize risks and avoid situations in which a malfunction or failure could cause bodily injury or damage to property; 4) When using the products, please do not exceed the maximum rating of the products, Stress above one or more limiting values will cause damage to the product and the equipment or affect the reliability to the equipment (customers' product); 5) Ensure customers' product using Silan's product are designed, manufactured and used in full compliance with all applicable standards, safety standards and other requirements of the customers' industry. The parameters stated in this instruction may and do vary in different applications, actual performance may vary over time. Customers must use the products within their effective static storage period, please contact Silan sales or Silan customer service support and sales management department if there is any questions about the effective static storage period, Silan does not assume any responsibility if the product has exceeded the static storage period when it is used.
5. Do not disassemble, reverse-engineer, alter, modify, decompile or copy product, without Silan's prior written consent.
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7. Please use and apply product in compliance with all applicable laws and regulations, including but not limited to trade control regulations etc. The product is civil electronic product, please do not use it in non-civil fields.
8. Product promotion is endless, our company will wholeheartedly provide customers with better products!
9. Website: <http://www.silan.com.cn>

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Rev.: 1.3

Revision History:

1. Add SVSP65R280FJHDD4 (TO-220FJHD-3L) package
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Rev.: 1.2

Revision History:

1. Add SVSP65R280SD4(TO-263-2L) package
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Rev.: 1.1

Revision History:

1. Update TO-220-3L package
  2. Modify ordering information
  3. Update the parameter and curve
- 

Rev.: 1.0

Revision History:

1. First release
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