

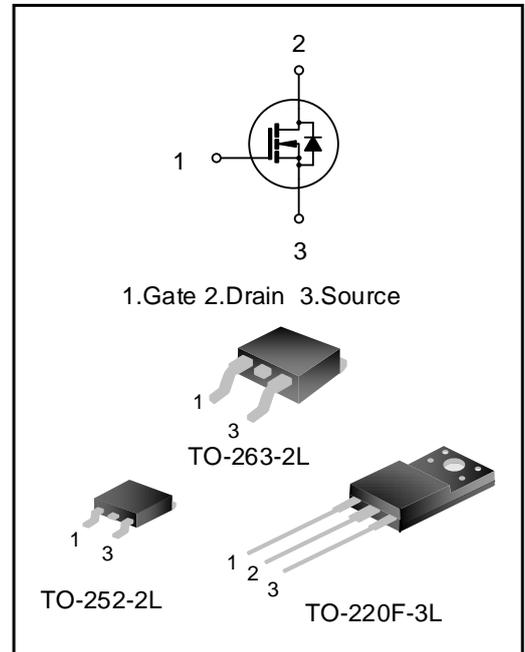
## 14A, 650V SUPER JUNCTION MOS POWER TRANSISTOR

### DESCRIPTION

STS65R280D(F)(S)S2 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
$V_{DS}$	650	V
$V_{GS(th)}$	2.5~4.5	V
$R_{DS(on),max.}$	0.28	$\Omega$
$I_{D,pulse}$	56	A
$Q_{g,typ.}$	23	nC

### ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing Type
STS65R280DS2TR	TO-252-2L	65R28DS2	Halogen free	Tape & Reel
STS65R280FS2	TO-220F-3L	65R280FS2	Halogen free	Tube
STS65R280SS2TR	TO-263-2L	65R280SS2	Halogen free	Tape & Reel
STS65R280SS2	TO-263-2L	65R280SS2	Halogen free	Tube

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

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Drain-source Voltage	$V_{DS}$	--	650	--	--	V
Gate-source Voltage (Static)	$V_{GS}$	--	-30	--	30	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 (STS65R280DS2) (Note 2)	$P_D$	$T_C=25^\circ\text{C}$	--	--	125	W
Power Dissipation (STS65R280FS2) (Note 2)	$P_D$	$T_C=25^\circ\text{C}$	--	--	32	W
Power Dissipation (STS65R280SS2) (Note 2)	$P_D$	$T_C=25^\circ\text{C}$	--	--	147	W
Single Pulsed Avalanche Energy	$E_{AS}$	$L=79\text{mH}$ , $V_{DD}=100\text{V}$ , $R_G=25\Omega$ , starting temperature $T_J=25^\circ\text{C}$	--	--	263	mJ
Single Pulsed Avalanche Current	$I_{AS}$	--	--	--	2.4	A
Reverse Diode dv/dt	dv/dt	$V_{DS}=0\sim 400\text{V}$ , $I_{SD}\leq I_S$ , $T_J=25^\circ\text{C}$	--	--	50	V/ns
MOSFET dv/dt Ruggedness	dv/dt	$V_{DS}=0\sim 480\text{V}$	--	--	100	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	$I_{S,pulse}$		--	--	8.8	A
Maximum Diode Commutation Speed	di/dt	$V_{DS}=0\sim 400\text{V}$ , $I_{SD}\leq I_S$ , $T_J=25^\circ\text{C}$	--	--	250	A/ $\mu\text{s}$

## THERMAL CHARACTERISTICS

Table 1. TO-252-2L (STS65R280DS2) thermal characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	1.0	°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 2. TO-220F-3L (STS65R280FS2) thermal characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	3.9	°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 3. TO-263-2L (STS65R280SS2) thermal characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Thermal Resistance, Junction-case, Bottom	$R_{\theta JC}$	--	--	--	0.85	°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	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	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	$I_{GSS}$	$V_{GS}=\pm 30V, V_{DS}=0V$	--	--	$\pm 100$	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	$R_{DS(on)}$	$V_{GS}=10V, I_D=7.0A$	--	0.24	0.28	$\Omega$
Gate Resistance	$R_G$	$f=1\text{MHz}$	--	2.9	--	$\Omega$

### Dynamic characteristics

Characteristics	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Input Capacitance	$C_{iss}$	$f=1\text{MHz}, V_{GS}=0V, V_{DS}=100V$	--	1062	--	pF
Output Capacitance	$C_{oss}$		--	38	--	
Reverse Transfer Capacitance	$C_{rss}$		--	1.6	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=380V, V_{GS}=10V,$ $R_G=25\Omega, I_D=14A$ (Notes 3, 4)	--	19	--	ns
Turn-on Rise Time	$t_r$		--	37	--	
Turn-off Delay Time	$t_{d(off)}$		--	53	--	
Turn-off Fall Time	$t_f$		--	32	--	
Total Gate Charge	$Q_g$	$V_{DD}=480V, V_{GS}=10V, I_D=14A$ (Notes 3, 4)	--	23	--	nC
Gate-source Charge	$Q_{gs}$		--	8.1	--	
Gate-drain Charge	$Q_{gd}$		--	8.2	--	
Gate-plateau Voltage	$V_{plateau}$		--	6.6	--	V

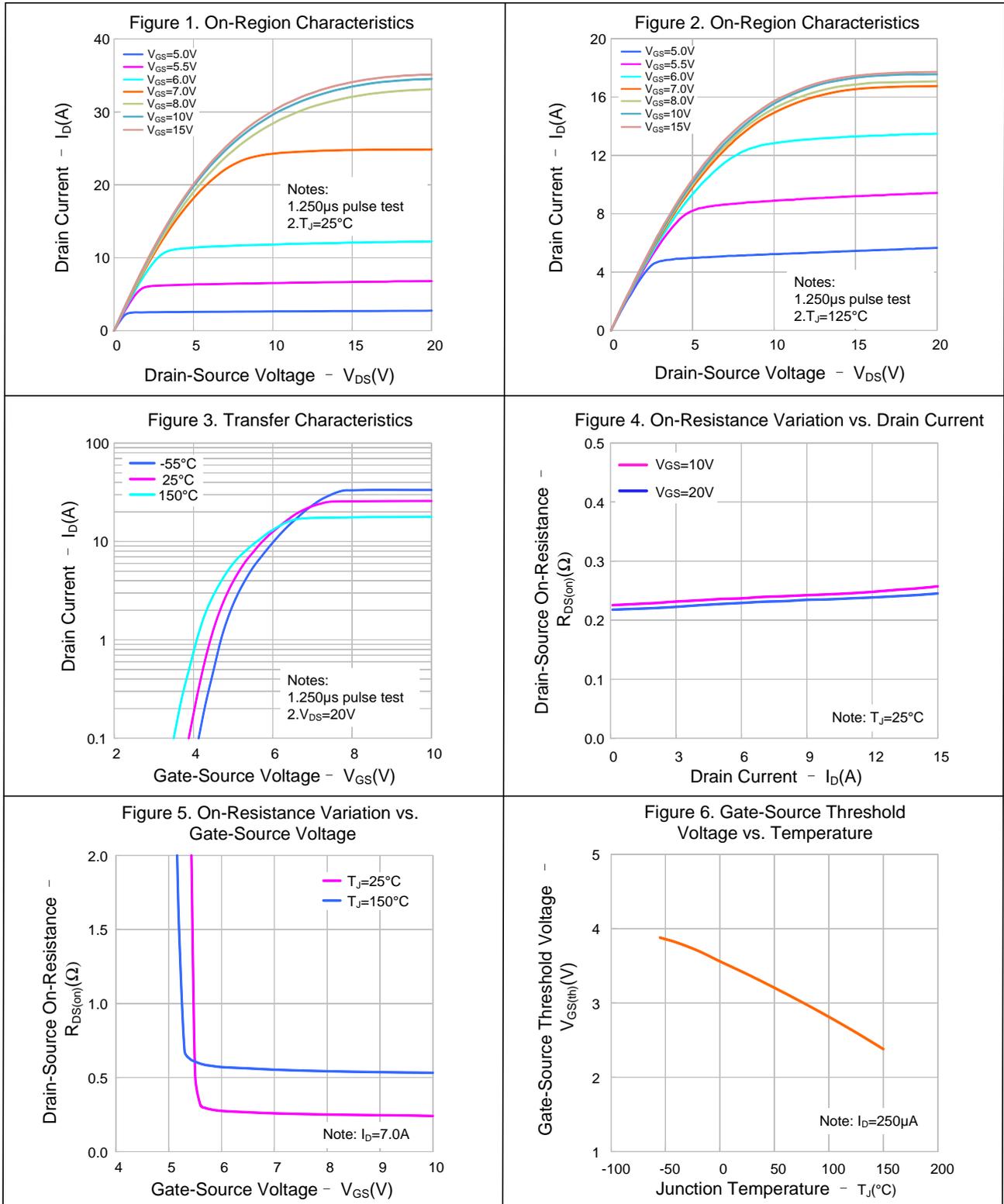
### Reverse diode characteristics

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	$T_{rr}$	$I_S=14A, V_{GS}=0V, di_F/dt=100A/\mu s$ (Note 3)	--	243	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	2.9	--	$\mu C$
Reverse Recovery Peak Current	$I_{rrm}$		--	28	--	A

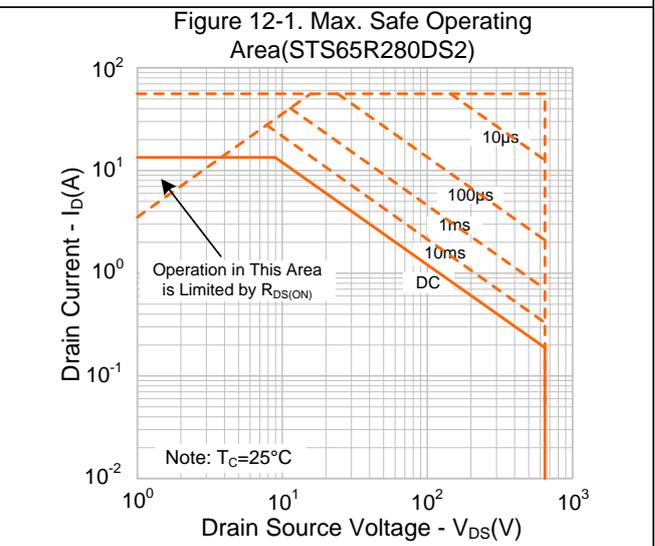
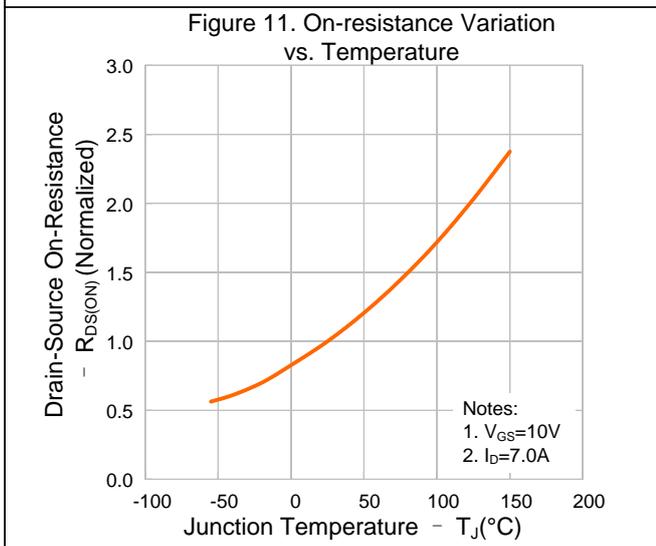
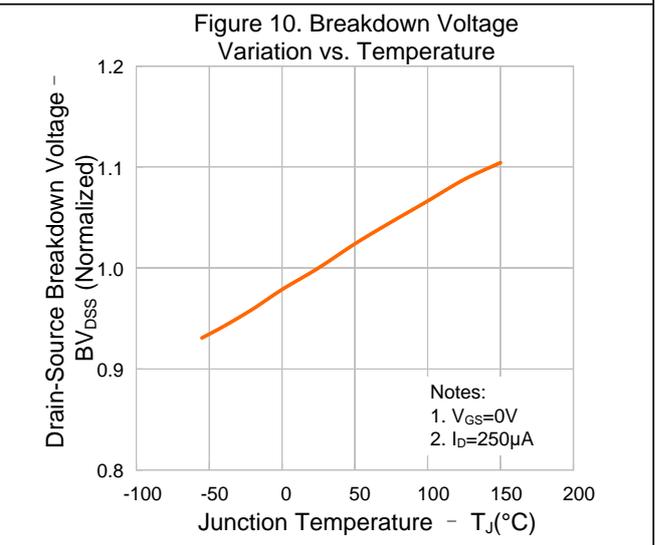
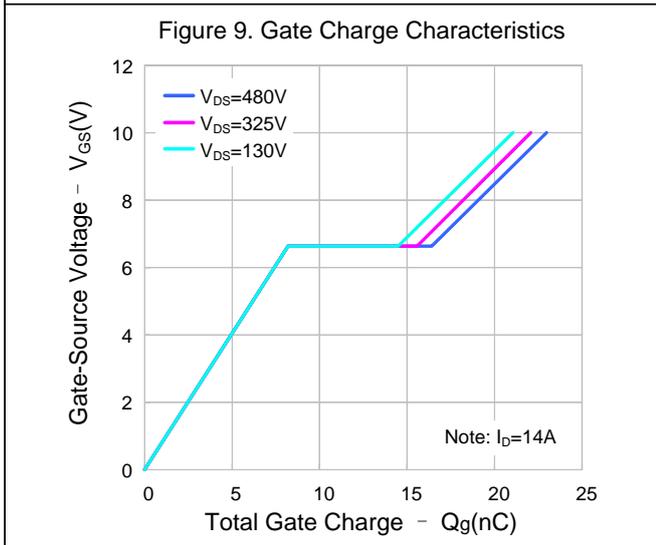
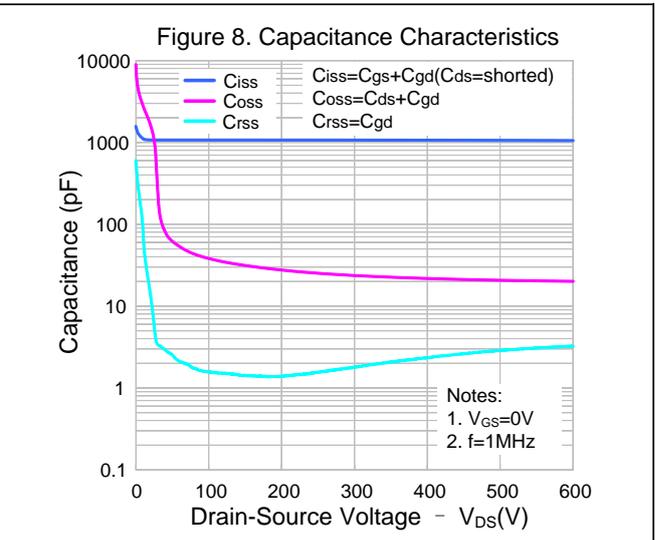
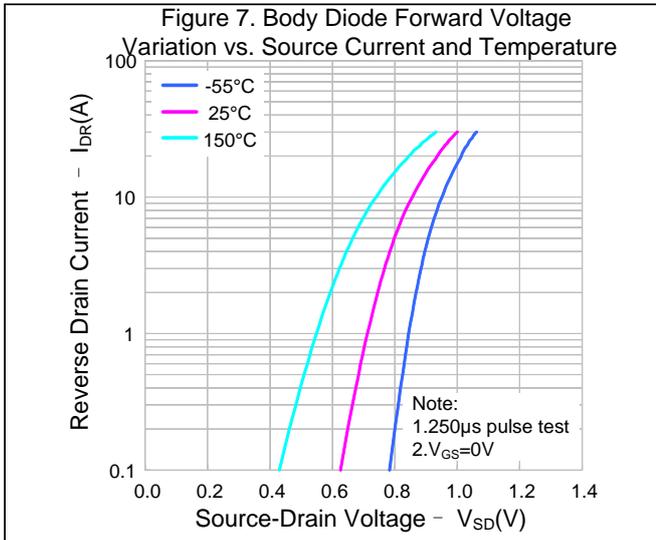
### Notes:

- Pulse time  $5\mu s$ ;
- The dissipation power will change with temperature, derating above  $25^\circ\text{C}$ :  
 $1.0W/^\circ\text{C}(\text{TO-252-2L}) / 0.26W/^\circ\text{C}(\text{TO-220F-3L}) / 1.18W/^\circ\text{C}(\text{TO-263-2L})$ ;
- Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ ;
- Essentially independent of operating temperature.

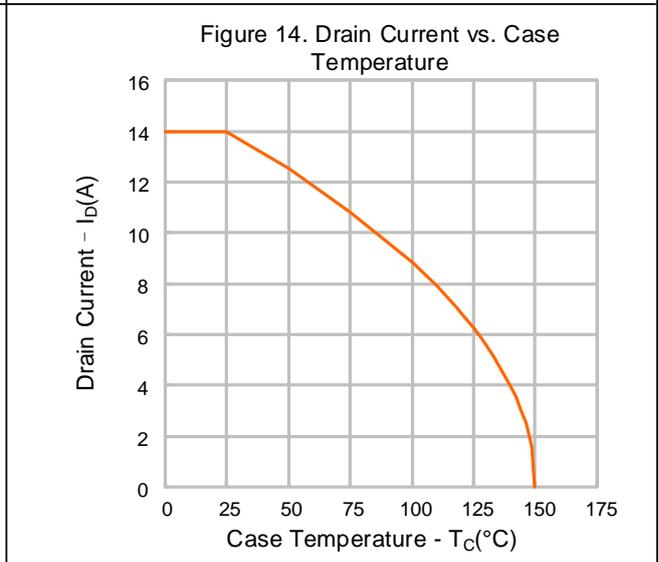
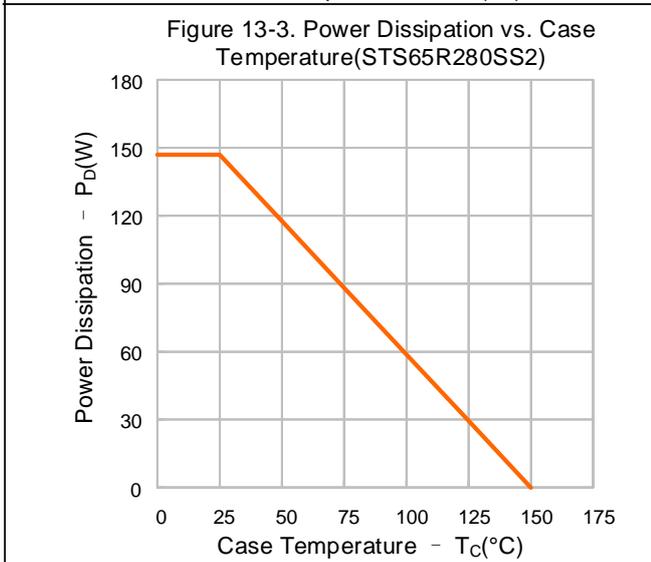
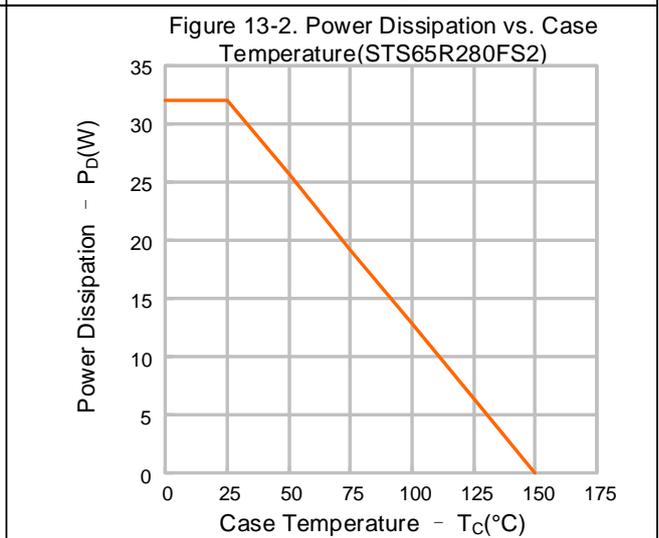
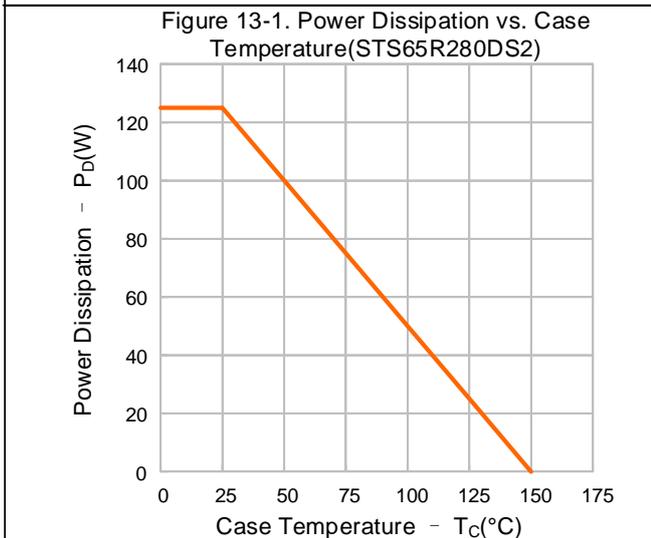
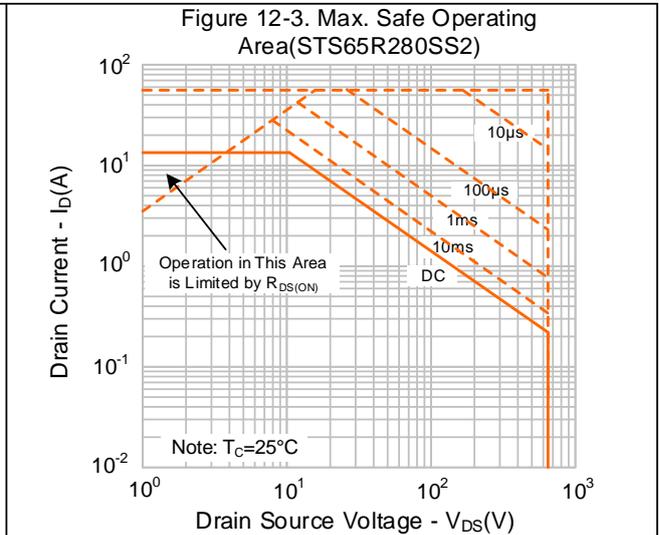
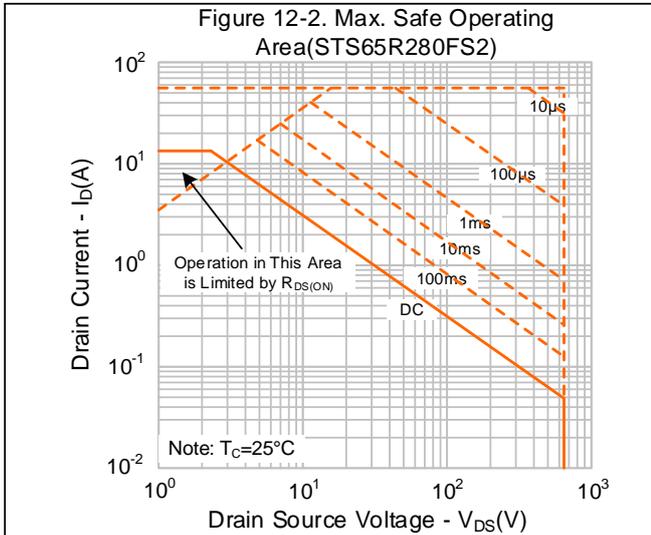
**TYPICAL CHARACTERISTICS**



TYPICAL CHARACTERISTICS (CONTINUED)

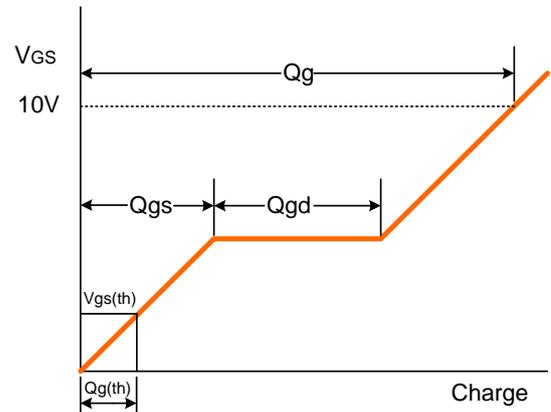
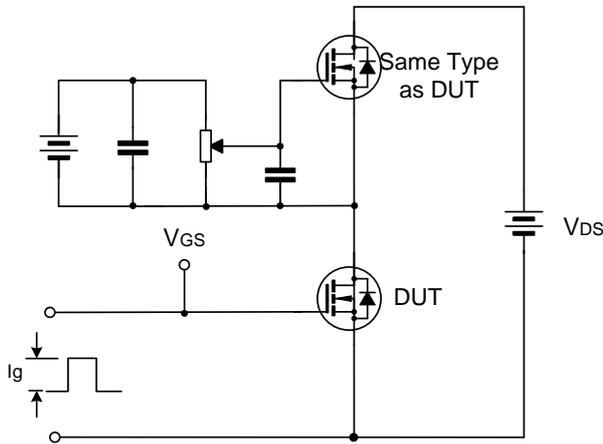


**TYPICAL CHARACTERISTICS (CONTINUED)**

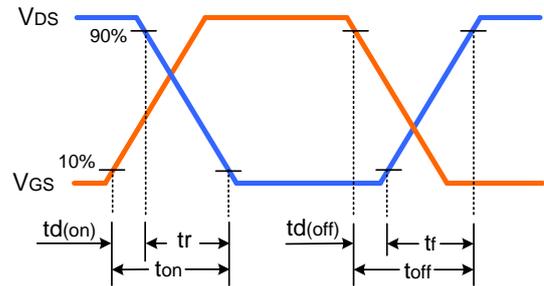
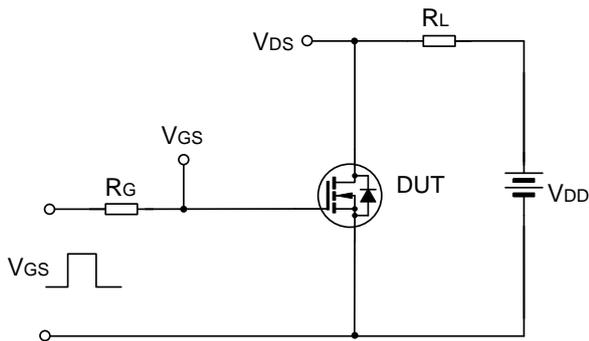


**TYPICAL TEST CIRCUIT**

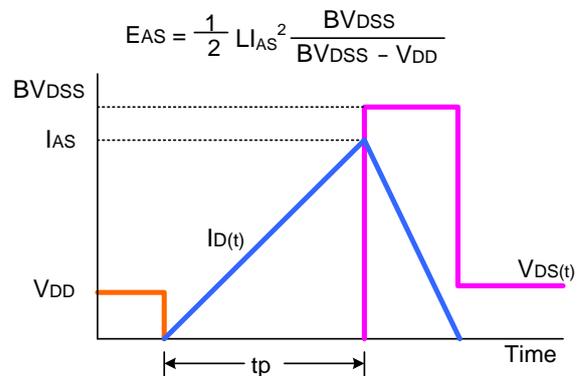
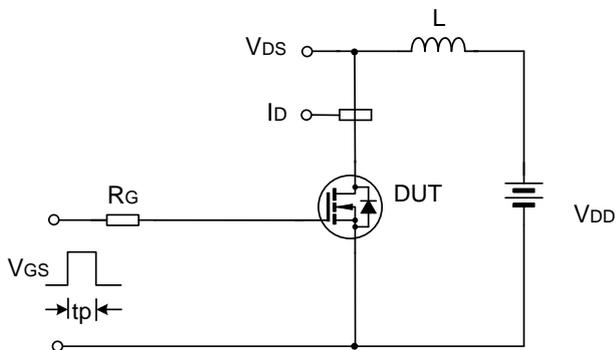
**Gate Charge Test Circuit & Waveform**



**Resistive Switching Test Circuit & Waveform**

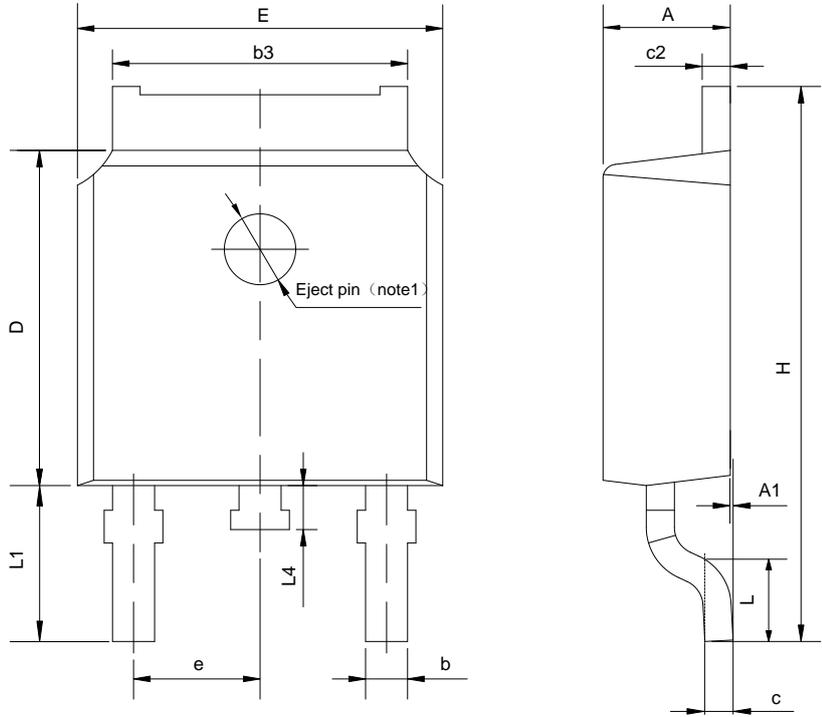


**Unclamped Inductive Switching Test Circuit & Waveform**



**PACKAGE OUTLINE**

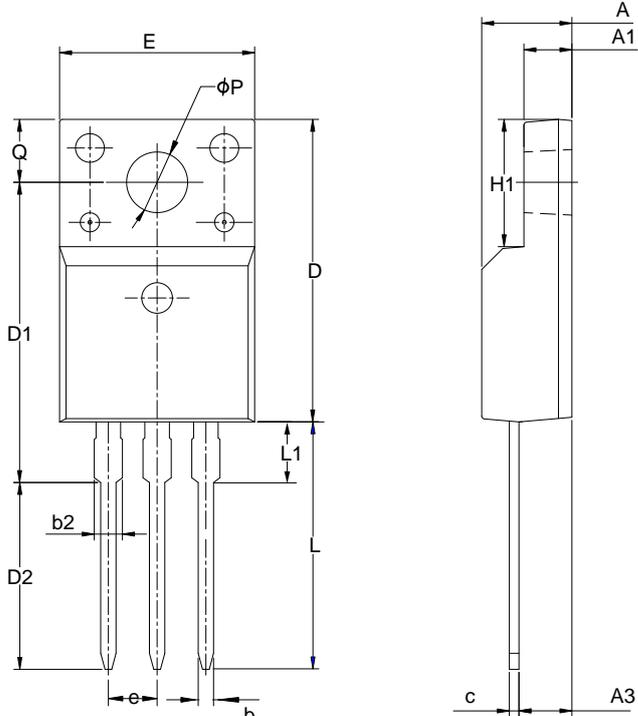
**TO-252-2L** **UNIT: mm**



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

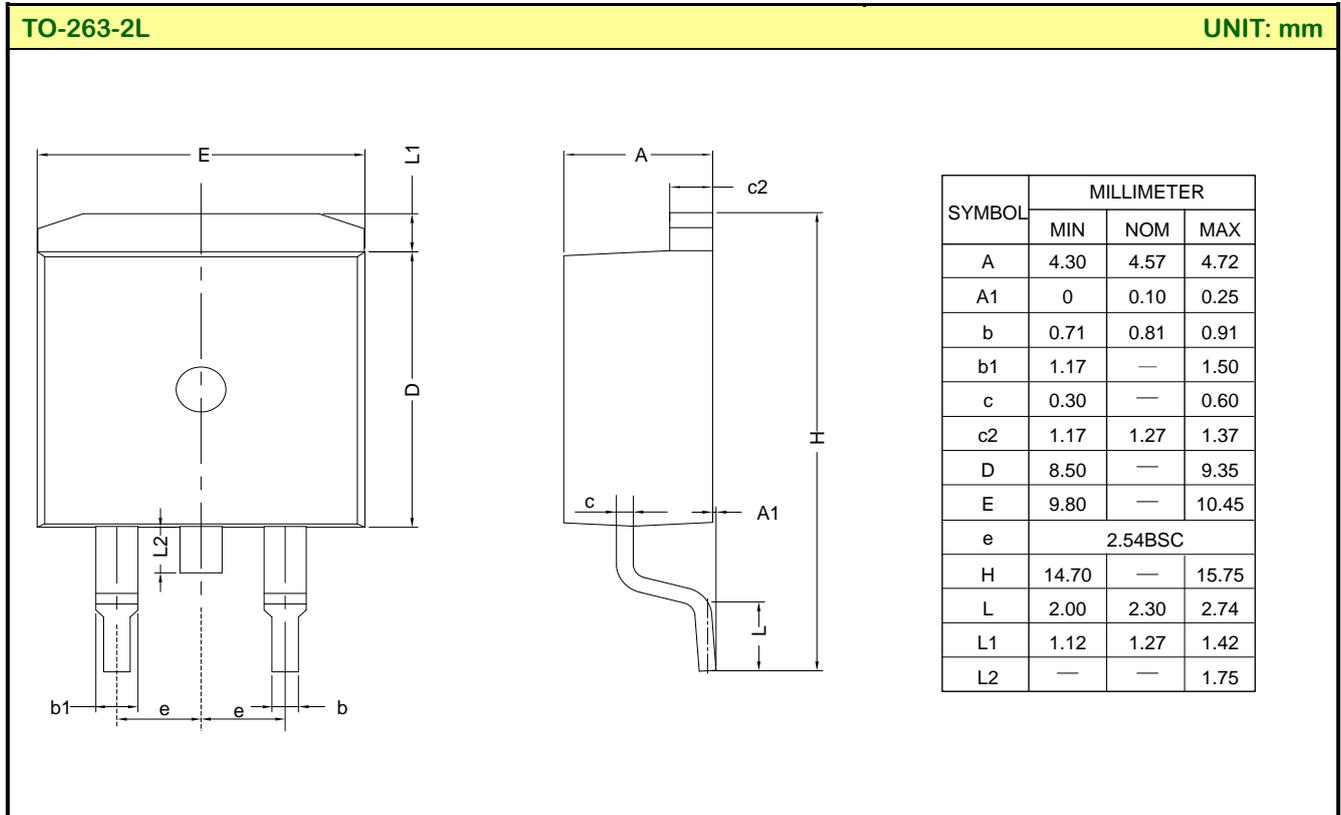
**NOTE1** : There are two conditions for this position:has an eject pin or has no eject pin.

**TO-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)**



**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.
3. The products belong to consumer electronic products. Silan does not give any warranties as to the suitability of the Silan's product for any specific use. The design intent, design definition and design of the product are not intended for application (the application stated in this instruction includes use, etc.) in transportation equipment, medical equipment, life-saving equipment, aerospace equipment, , non-civil equipment or non-civil use, etc. (the equipment stated in this instruction includes systems, devices, etc., all referred to as equipment).The product should not be used in any equipment or system whose manufacture, use or sale is prohibited under any applicable laws or regulations ("unintended use"). If the product is used for unintended use, therefore the full risks of such products application are borne by the customer and Silan assumes no liability for the product used for the unintended use. If the customer intends to use the Silan's product in a application where malfunction or failure can be reasonably be expected to result in personal injury, or serious property, or environment damage, the customer shall make adequate assessment, testing and verification, and Silan shall not be liable for such applications.
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5. Do not disassemble, reverse-engineer, alter, modify, decompile or copy product, without Silan's prior written consent.
6. Please identify Silan's trademark when purchasing our product. Please contact us if there is any question. Our products are not sold through TAOBAO or any other third-party e-commerce platforms. If customers purchase from such platforms, please contact us in writing before purchasing to confirm whether the product is authentic and original from Silan.
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.: 1.2

Revision History:

1. Add TO-263-2L package
  2. Update typical characteristics
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Rev.: 1.1

Revision History:

1. Add TO-220F-3L package
  2. Update typical characteristics
  3. Update important notice
- 

Rev.: 1.0

Revision History:

1. First release
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