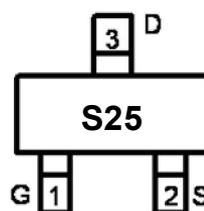


## Main Product Characteristics

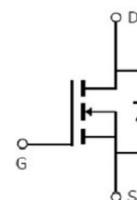
$V_{DSS}$	20V
$R_{DS(on)}$	28mohm(typ.)
$I_D$	4.5A



SOT23-3



Marking and Pin Assignment



Schematic Diagram

## Features and Benefits

- Advanced trench MOSFET process technology
- Special designed for battery protection, load switching and general power management
- Ultra low on-resistance with low gate charge
- Fast switching and reverse body recovery
- 150°C operating temperature
- Lead free product



## Description

It utilizes the latest trench processing techniques to achieve the high cell density and reduces the on-resistance with high repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in battery protection, power switching application and a wide variety of other applications.

## Absolute Max Rating

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	±10	V
Drain Current-Continuous@ Current-Pulsed (Note 1)	$I_D$	4.5	A
	$I_{DM}$	18	A
Maximum Power Dissipation	$P_D$	1.1	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	°C

## Thermal Resistance

Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	110	°C/W
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# SSF2160G4

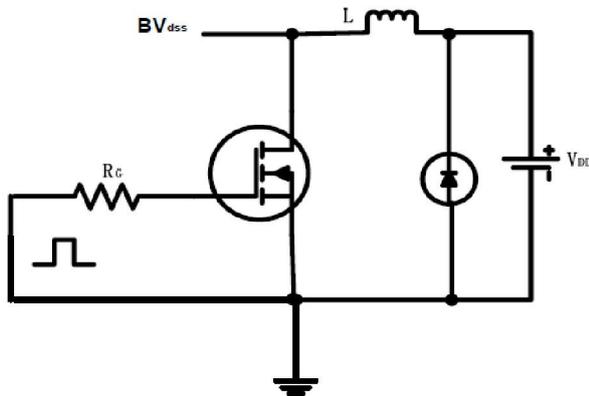
## 20V N-Channel MOSFET

### Electrical Characteristics @ $T_A=25^{\circ}\text{C}$ unless otherwise specified

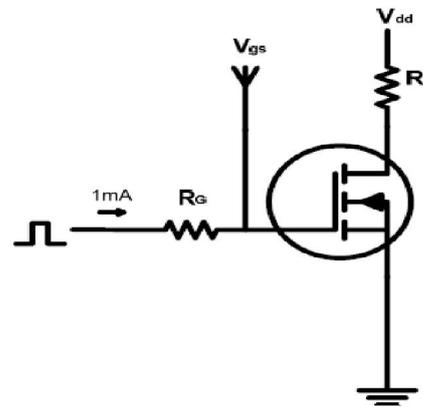
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	20			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=20V, V_{GS}=0V$			1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 10V, V_{DS}=0V$			$\pm 100$	nA
<b>ON CHARACTERISTICS (Note 3)</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.65	0.75	1.2	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=4.5V, I_D=3.6A$		28	40	m $\Omega$
		$V_{GS}=2.5V, I_D=3.1A$		36	60	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=3.6A$	4			S
<b>DYNAMIC CHARACTERISTICS (Note4)</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=10V, V_{GS}=0V,$ $F=1.0MHz$		500		PF
Output Capacitance	$C_{oss}$			125		PF
Reverse Transfer Capacitance	$C_{riss}$			70		PF
<b>SWITCHING CHARACTERISTICS (Note 4)</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=10V, I_D=3.6A$ $V_{GS}=4.5V, R_{GEN}=6\Omega$		7		nS
Turn-on Rise Time	$t_r$			5.3		nS
Turn-Off Delay Time	$t_{d(off)}$			16		nS
Turn-Off Fall Time	$t_f$			10		nS
Total Gate Charge	$Q_g$	$V_{DS}=10V, I_D=4.2A,$ $V_{GS}=4.5V$		10		nC
Gate-Source Charge	$Q_{gs}$			2.3		nC
Gate-Drain Charge	$Q_{gd}$			2.9		nC
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=0.94A$		0.8	1.2	V
Diode Forward Current (Note 2)	$I_S$				4.5	A

## Test Circuits and Waveforms

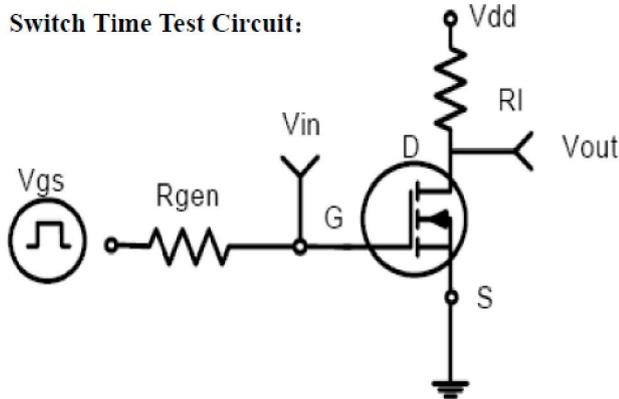
EAS test circuits:



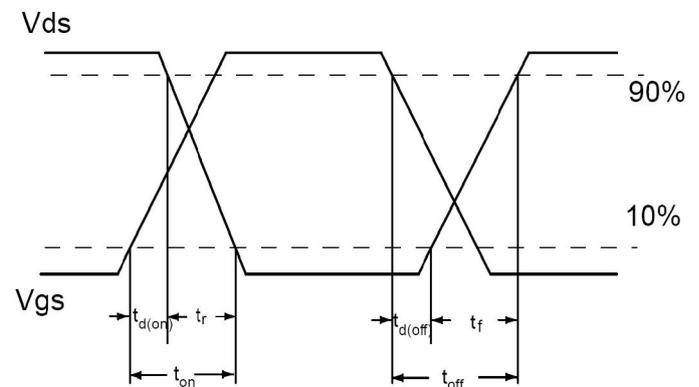
Gate charge test circuit:



Switch Time Test Circuit:



Waveforms:



### NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production testing.

## Typical Electrical and Thermal Characteristics

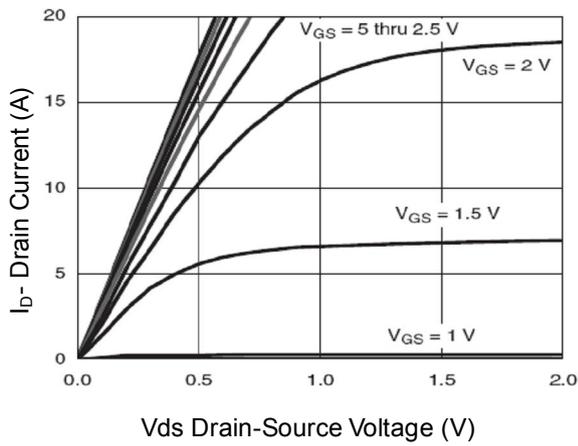


Figure 1: Typical Output Characteristics

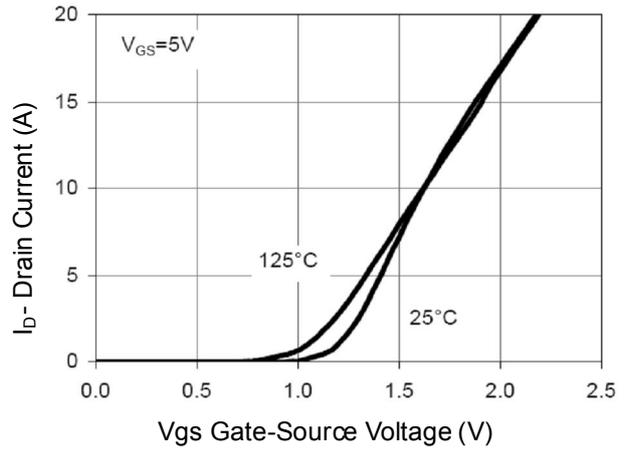


Figure 2: Transfer Characteristics

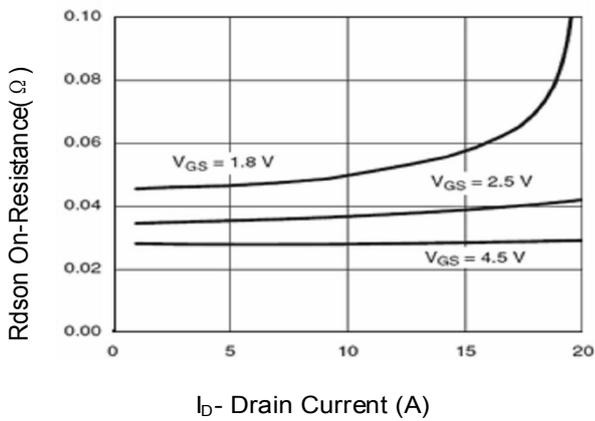


Figure 3: Drain-Source On-Resistance

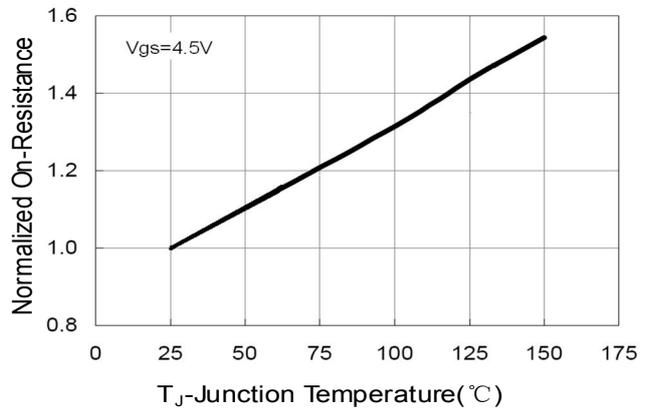


Figure 4: Drain-Source On-Resistance

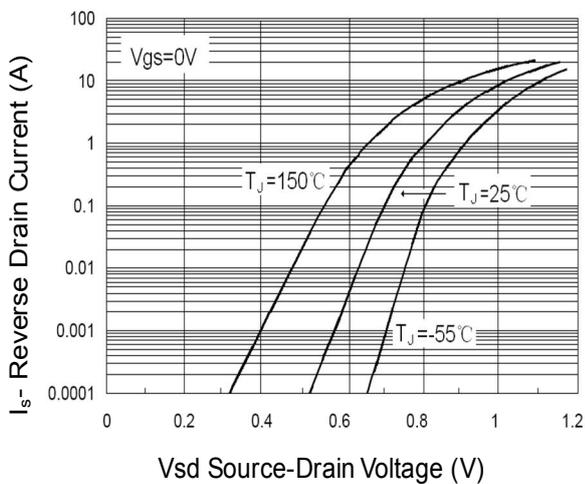


Figure 5 : Source- Drain Diode Forward

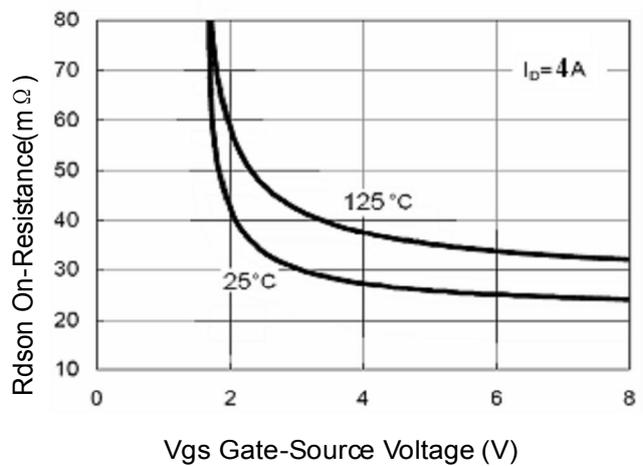


Figure 6: Rds(on) vs Vgs

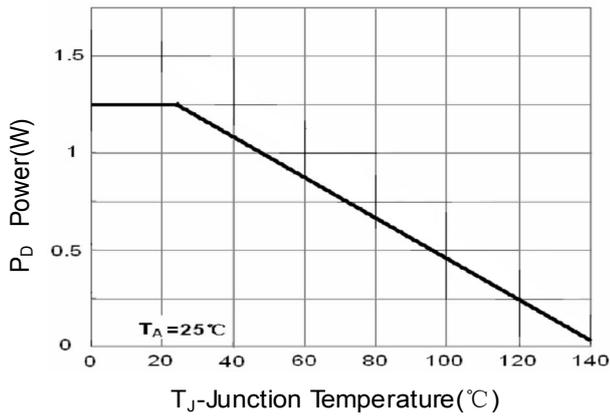


Figure 7: Power Dissipation

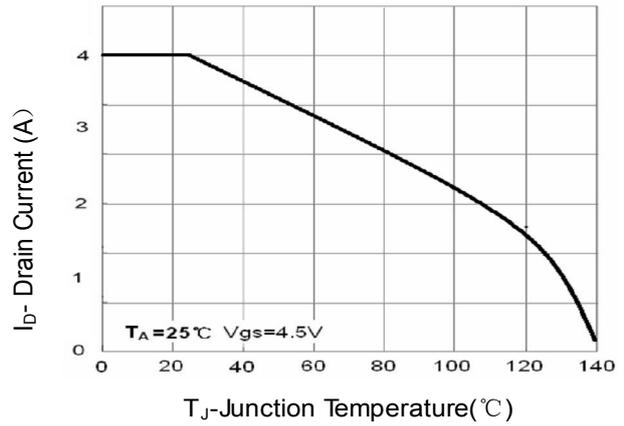


Figure 8: Drain Current

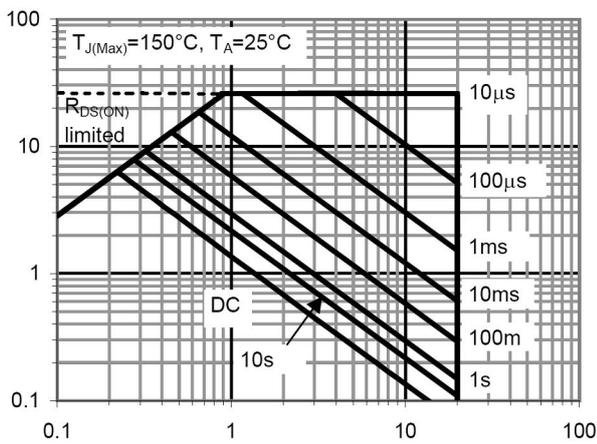


Figure 9: Safe Operation Area

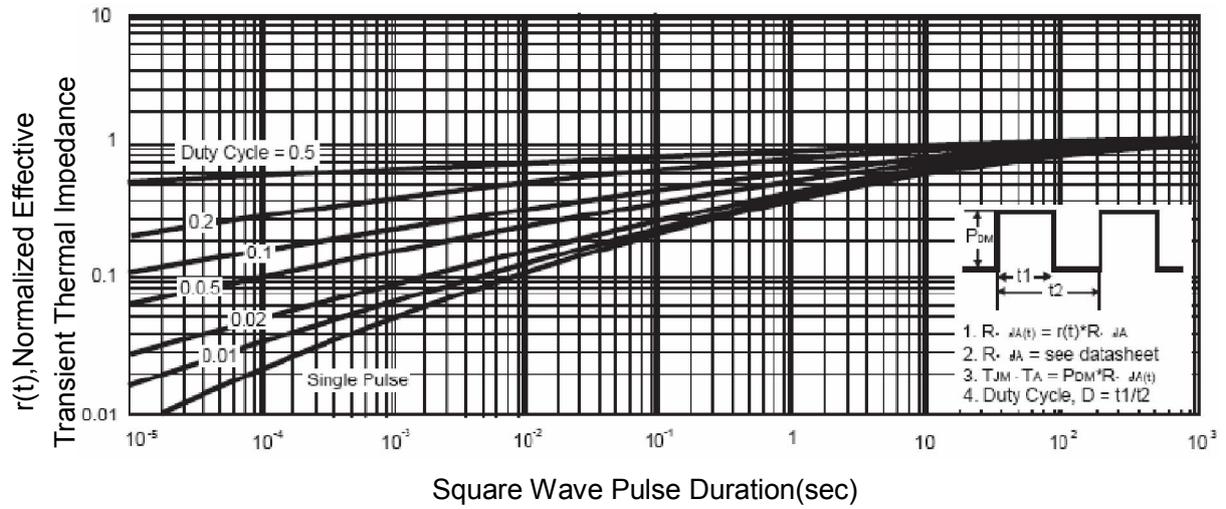
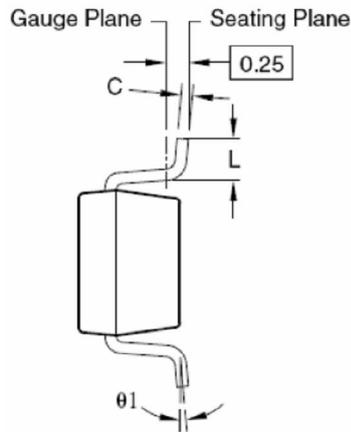
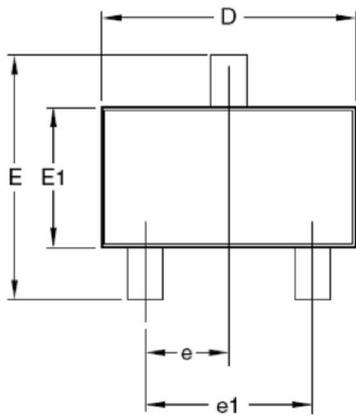


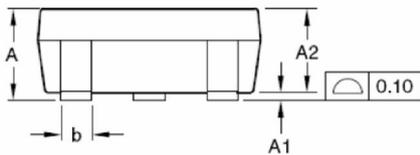
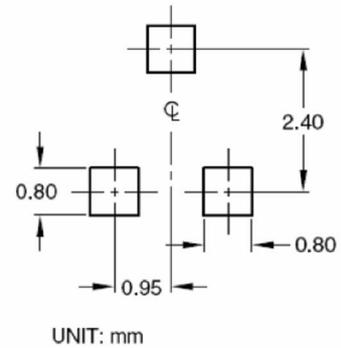
Figure 10: Normalized Maximum Transient Thermal Impedance

## Mechanical Data

### SOT23-3 Dimensions in Millimeters (UNIT:mm)



#### RECOMMENDED LAND PATTERN



#### Dimensions in millimeters

Symbols	Min.	Nom.	Max.
A	0.90	—	1.25
A1	0.00	—	0.13
A2	0.70	1.00	1.15
b	0.30	0.40	0.50
C	0.08	0.13	0.20
D	2.80	2.90	3.10
E	2.60	2.80	3.00
E1	1.40	1.60	1.80
e	0.95 BSC		
e1	1.90 BSC		
L	0.30	—	0.60
θ1	0°	5°	8°

#### Dimensions in inches

Symbols	Min.	Nom.	Max.
A	0.035	—	0.049
A1	0.000	—	0.005
A2	0.028	0.039	0.045
b	0.012	0.016	0.020
C	0.003	0.005	0.008
D	0.110	0.114	0.122
E	0.102	0.110	0.118
E1	0.055	0.063	0.071
e	0.037 BSC		
e1	0.075 BSC		
L	0.012	—	0.024
θ1	0°	5°	8°

#### NOTES:

1. Tolerance  $\pm 0.10\text{mm}$  (4 mil) unless otherwise specified
2. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
3. Dimension L is measured in gauge plane.
4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.



### Ordering and Marking Information

<b>Device Marking: S25</b>	<b>Package (Available)</b> <b>SOT23-3</b> <b>Operating Temperature Range</b> <b>C : -55 to 150 °C</b>
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### Devices per Unit

Package Type	Units/ Tube	Tubes/ Inner Box	Units/ Inner Box	Inner Boxes/ Carton Box	Units/ Carton Box
SOT23-3	3000pcs	10pcs	30000pcs	4pcs	120000pcs

### Reliability Test Program

Test Item	Conditions	Duration	Sample Size
High Temperature Reverse Bias(HTRB)	$T_j=125^{\circ}\text{C}$ or $150^{\circ}\text{C}$ @ 80% of Max $V_{DSS}/V_{CES}/V_R$	168 hours 500 hours 1000 hours	3 lots x 77 devices
High Temperature Gate Bias(HTGB)	$T_j=125^{\circ}\text{C}$ or $150^{\circ}\text{C}$ @ 100% of Max $V_{GSS}$	168 hours 500 hours 1000 hours	3 lots x 77 devices