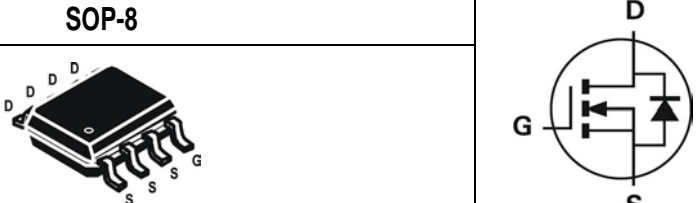
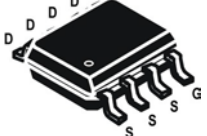


$V_{DS}$ , 40V $R_{DS(ON)}$ , 11m $\Omega$ (max.) @ $V_{GS}=10V$ $R_{DS(ON)}$ , 16m $\Omega$ (max.) @ $V_{GS}=4.5V$ $I_D$ , 11A	SOP-8	
		

Description	Features
<p>The SG40N04S uses advanced Trench technology and designs to provide excellent <math>R_{DS(ON)}</math> with low gate charge. This device is suitable for use in PWM, load switching and general purpose applications.</p>	<ul style="list-style-type: none"> <li>Low On-Resistance</li> <li>Low Input Capacitance</li> <li>Low Miller Charge</li> <li>Low Input/Output Leakage</li> </ul>
	<b>Applications</b> <ul style="list-style-type: none"> <li>Lithium-Ion Secondary Batteries</li> <li>Load Switch</li> <li>DC-DC converters and Off-line UPS</li> </ul>

Ordering Information					
Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
SG40N04S	Halogen-Free	SOP-8	S	Tape & Reel	2,500

Absolute Maximum Ratings ( $T_A=25^{\circ}C$ unless otherwise noted)				
Parameter		Symbol	Value	Unit
Drain-Source Voltage		$V_{DS}$	40	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	V
Drain Current-Continuous <sup>Note 1</sup>	$T_A=25^{\circ}C$	$I_D$	11	A
	$T_A=70^{\circ}C$		49	A
Drain Current-Pulsed <sup>Note 1</sup>		$I_{DM}$	36	A
Avalanche Current		$I_{AS}$	26	A
Avalanche Energy, $L=0.1mH$		$E_{AS}$	33	mJ
Maximum Power Dissipation	$T_A=25^{\circ}C$	$P_D$	1.5	W
Storage Temperature Range		$T_{STG}$	-55 to +150	$^{\circ}C$
Operating Junction Temperature Range		$T_J$	-55 to +150	$^{\circ}C$

Thermal Resistance Ratings						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Maximum Junction-to-Ambient <sup>Note 2</sup>	$R_{\theta JA}$	Steady State	-	-	65	$^{\circ}C/W$
Maximum Junction-to-Case	$R_{\theta JC}$	Steady State	-	-	30	$^{\circ}C/W$

### Electrical Characteristics ( $T_J=25^{\circ}\text{C}$ unless otherwise noted)

#### OFF CHARACTERISTICS

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_{DS}=250\mu A$	40	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=32V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA

#### ON CHARACTERISTICS

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	1	-	2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_{DS}=8A$	-	-	11	m $\Omega$
		$V_{GS}=4.5V, I_{DS}=6A$	-	-	16	m $\Omega$

#### DYNAMIC CHARACTERISTICS

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Capacitance	$C_{iss}$	$V_{DS}=15V, V_{GS}=0V, f=1\text{MHz}$	-	1274	-	pF
Output Capacitance	$C_{oss}$		-	116	-	
Reverse Transfer Capacitance	$C_{rss}$		-	85	-	

#### SWITCHING CHARACTERISTICS

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Turn-On Delay Time	$T_{d(on)}$	$V_{DS}=12V, I_{DS}=6A, V_{GS}=10V, R_{GEN}=3.3\Omega$	-	8.3	-	ns
Rise Time	$t_r$		-	3.3	-	
Turn-Off Delay Time	$T_{d(off)}$		-	21	-	
Fall Time	$t_f$		-	2.1	-	
Total Gate Charge at 10V	$Q_g$	$V_{DS}=20V, I_{DS}=8A, V_{GS}=4.5V$	-	10.3	-	nC
Gate to Source Gate Charge	$Q_{gs}$		-	3.2	-	
Gate to Drain "Miller" Charge	$Q_{gd}$		-	4	-	

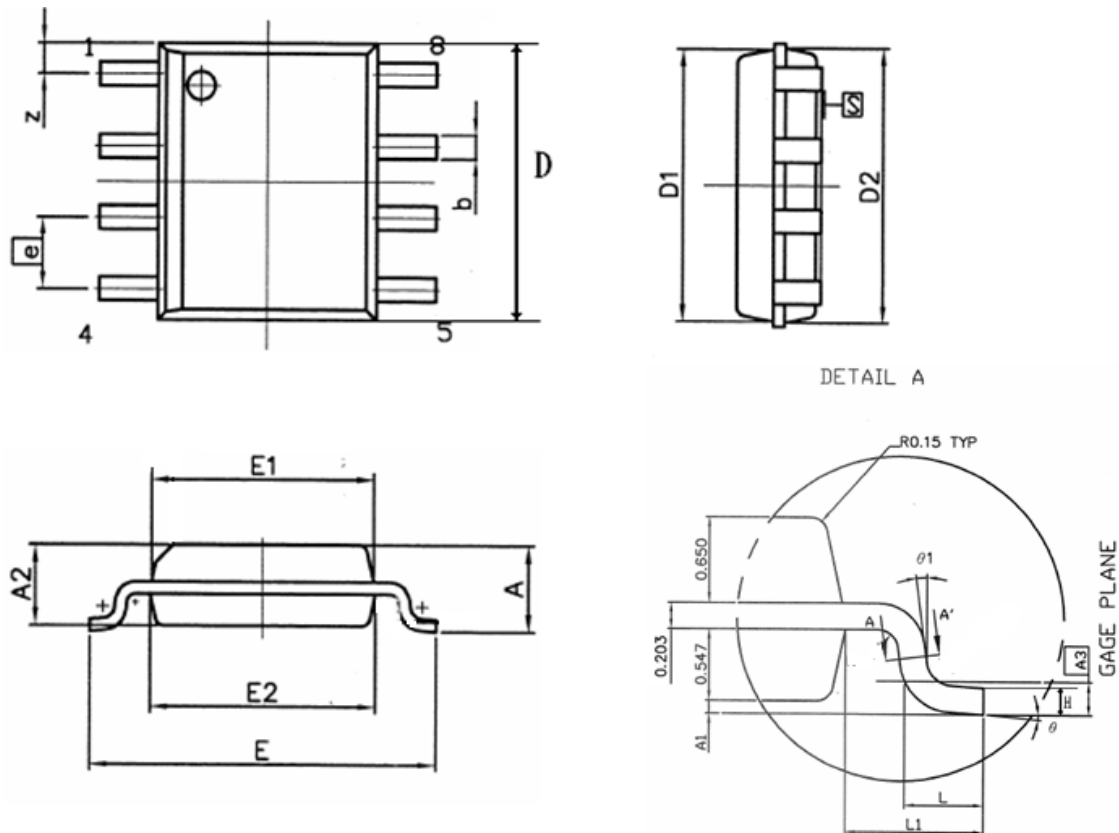
#### DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_{DS}=1A$	-	-	1.2	V
Body Diode Reverse Recovery Time	$I_S$	$V_G=V_{DS}=0V, \text{Force Current}$	-	-	11	A
Body Diode Reverse Recovery Charge	$I_{SM}$		-	-	36	A

#### Notes:

1. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
2.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.  $R_{\theta JA}$  shown below for single device operation on FR-4 in still air.
3. The maximum current rating is limited by package.

### Package Dimensions



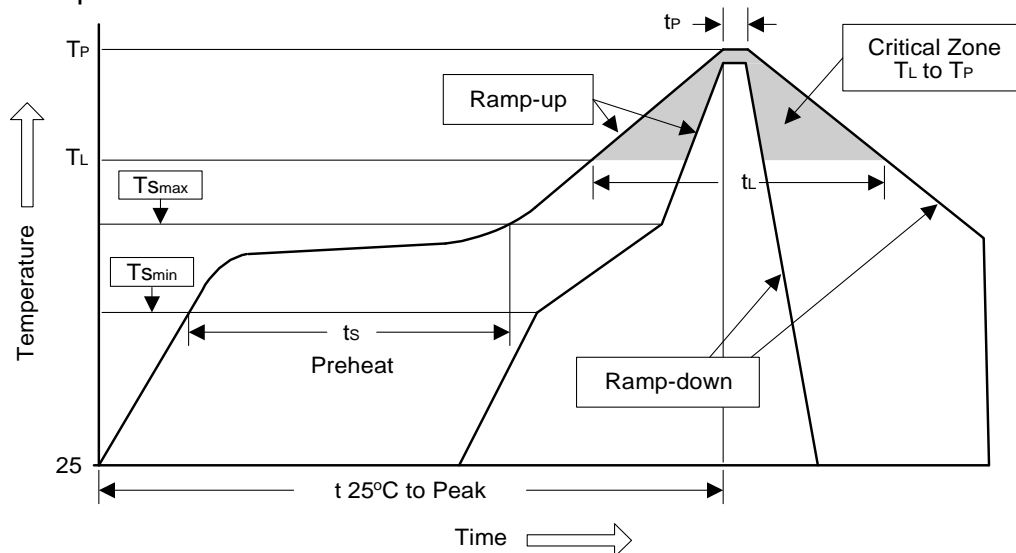
SOP-8 Dimensions

Symbols	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.35	1.55	1.753	0.053	0.061	0.069
A1	0.10	0.15	0.25	0.004	0.006	0.010
A2	1.27	1.52	1.626	0.050	0.060	0.064
A3	-	0.254	-	-	0.010	-
b	0.30	0.40	0.51	0.012	0.016	0.020
D	4.70	4.90	5.10	0.185	0.193	0.201
D1	4.70	4.90	5.00	0.185	0.193	0.197
D2	4.80	4.90	5.00	0.189	0.193	0.197
E	5.79	6.00	6.20	0.228	0.236	0.244
E1	3.75	3.90	4.00	0.148	0.154	0.157
E2	3.75	3.90	4.00	0.148	0.154	0.157
H	0.17	0.21	0.25	0.007	0.008	0.010
e	-	1.27	-	-	0.050	-
L	0.40	0.76	1.27	0.016	0.030	0.050
L1	0.95	1.05	1.15	0.037	0.041	0.045
$\theta$	0°	4°	8°	0°	4°	8°
$\theta 1$	0°	-	-	0°	-	-

### Soldering Methods for Major Power's Products

1. Storage environment: Temperature=10°C to 35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate ( $T_L$ to $T_P$ )	<3°C/sec	<3°C/sec
Preheat		
- Temperature Min ( $T_{smin}$ )	100°C	150°C
- Temperature Max ( $T_{smax}$ )	150°C	200°C
- Time (min to max) ( $t_s$ )	60 to 120 sec	60 to 180 sec
$T_{smax}$ to $T_L$		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature ( $T_L$ )	183°C	217°C
- Time ( $t_L$ )	60 to 150 sec	60 to 150 sec
Peak Temperature ( $T_P$ )	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature ( $t_p$ )	10 to 30 sec	20 to 40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

### 3. Flow (wave) soldering (solder dipping)

Products	Peak Temperature	Dipping Time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec

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