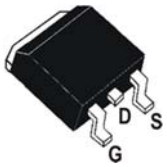
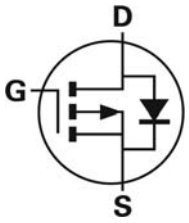
SGP4038D

-40V P-CHANNEL Power MOSFET

V_{DSS} , -40V $R_{DS(ON)}$, 50mΩ (max.) @ V_{GS}=-10V $R_{DS(ON)}$, 75mΩ (max.) @ V_{GS}=-4.5V I_D , -22.8A	**TO-252** 	

Description

The SGP4038D is the highest performance trench P-Ch MOSFETs with extreme high cell density, which provide excellent $R_{DS(ON)}$ and gate charge for most of the synchronous buck converter applications.

The SGP4038D meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

Features

- Low On-Resistance
- Low Input Capacitance
- Low Miller Charge
- Low Input/Output Leakage
- Pb-free lead plating; RoHS compliant

Applications

- Motor / Body Load Control
- Automotive Systems
- Load Switch
- DC-DC converters and Off-line UPS

Ordering Information

Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
SGP4038D	Halogen-Free	TO-252	D	Tape & Reel	2,500

Absolute Maximum Ratings (T_A=25°C unless otherwise noted)

Parameter		Symbol	Value	Unit
Drain-Source Voltage		V_{DS}	-40	V
Gate-Source Voltage		V_{GS}	±20	V
Drain Current-Continuous	T_C=25°C	I_D	-22.8	A
	T_C=100°C		-14.4	A
Drain Current-Pulsed Note 1		I_{DM}	-50	A
Avalanche Current, L=0.1mH		I_{AS}	-28	A
Avalanche Energy, L=0.1mH Note 3		E_{AS}	39.2	mJ
Maximum Power Dissipation	T_C=25°C	P_D	41.7	W
	T_C=100°C		16.7	W
Storage Temperature Range		T_{STG}	-55 to +175	°C
Operating Junction Temperature Range		T_J	-55 to +175	°C

Thermal Resistance Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Maximum Junction-to-Ambient Note 1	$R_{\theta JA}$	Steady State	-	-	62	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	Steady State	-	-	3	°C/W

Electrical Characteristics (T_J=25°C unless otherwise noted)

OFF CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_{DS}=-250μA	-40	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=-32V, V_{GS}=0V	-	-	-1	μA
Gate-Body Leakage	I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA

ON CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Gate Threshold Voltage	$V_{GS(TH)}$	V_{DS}=V_{GS}, I_{DS}=-250μA	-1	-	-2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=-10V, I_{DS}=-8A	-	35	50	mΩ
		V_{GS}=-4.5V, I_{DS}=-5A	-	45	75	
Forward Transconductance Note 1	gfs	V_{DS}=-5V, I_D=-18A	-	12	-	S

DYNAMIC CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Input Capacitance	C_{iss}	V_{DS}=-20V, V_{GS}=0V, f=1MHz	-	984	-	pF
Output Capacitance	C_{oss}		-	105	-	
Reverse Transfer Capacitance	C_{rss}		-	78	-	

SWITCHING CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Turn-On Delay Time	$T_{d(on)}$	V_{DD}=-20V, V_{GS}=-10V, R_G=3.3Ω, I_D=-18A	-	19	-	ns
Rise Time	t_r		-	12.6	-	
Turn-Off Delay Time	$T_{d(off)}$		-	47.6	-	
Fall Time	t_f		-	4.5	-	
Total Gate Charge at 10V	Q_g	V_{DS}=-20V, V_{GS}=-4.5V, I_D=-18A	-	8.8	-	nC
Gate to Source Gate Charge	Q_{gs}		-	2.4	-	
Gate to Drain “Miller” Charge	Q_{gd}		-	3	-	

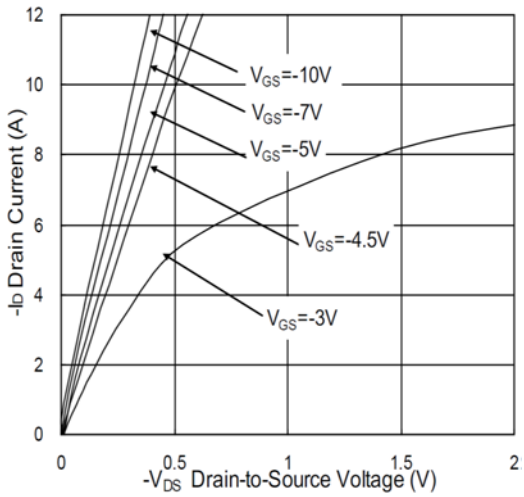
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Drain-Source Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_S=-18A	-	-	-1.2	V
Body Diode Reverse Recovery Time	I_S	V_G=V_D=0V, Force Current	-	-	-25	A
Body Diode Reverse Recovery Charge	I_{SM}		-	-	-50	A

Notes:

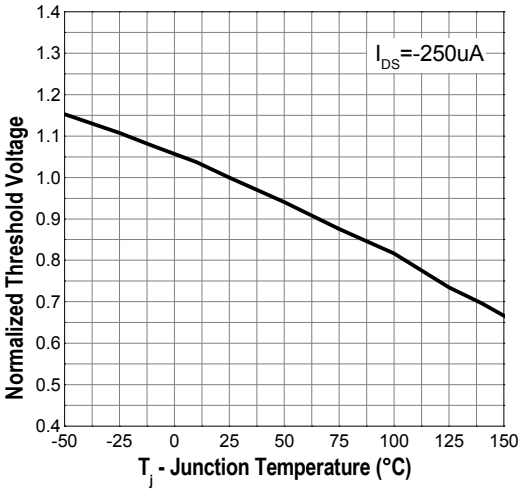
1. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
2. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ 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 EAS data shows Max. rating. The test condition is V_{DD}=-25V, V_{GS}=-10V, L=0.1mH, I_{AS}=-28A

Typical Operating Characteristics

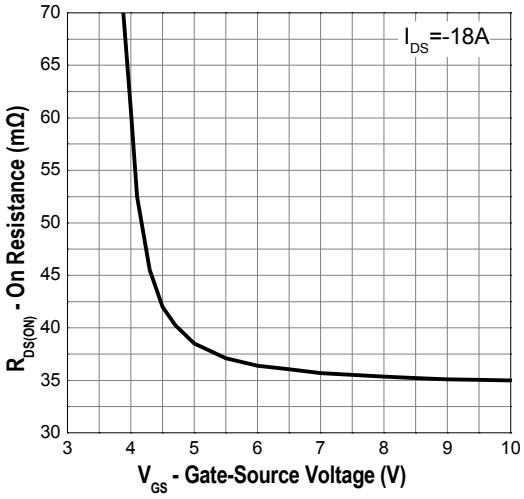
Output Characteristics



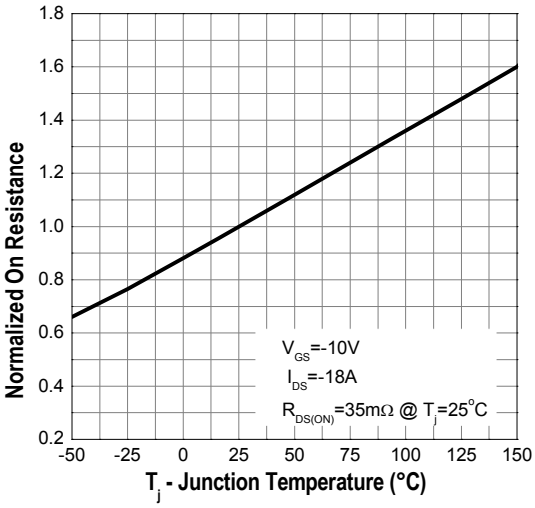
Gate Threshold Voltage



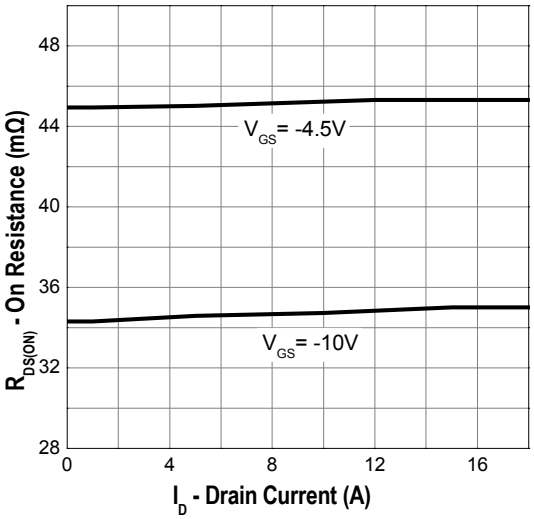
Gate-Source On Resistance



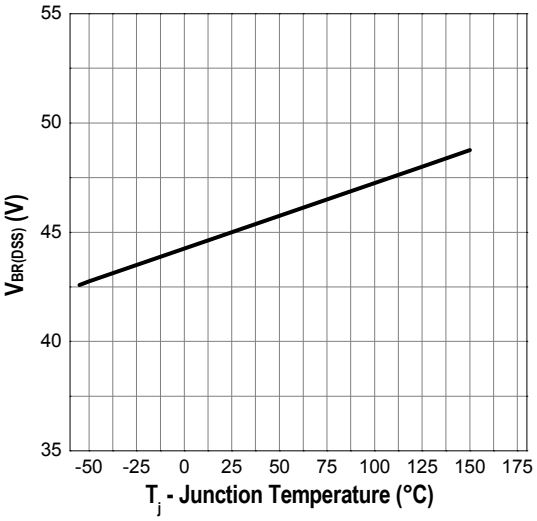
Drain-Source On Resistance



Drain-Source On Resistance

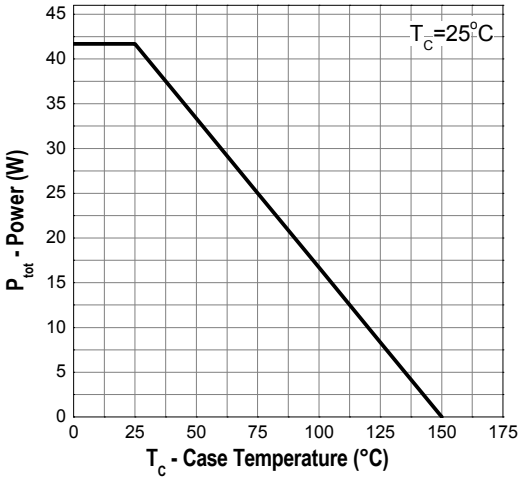


Source-Drain Diode Forward

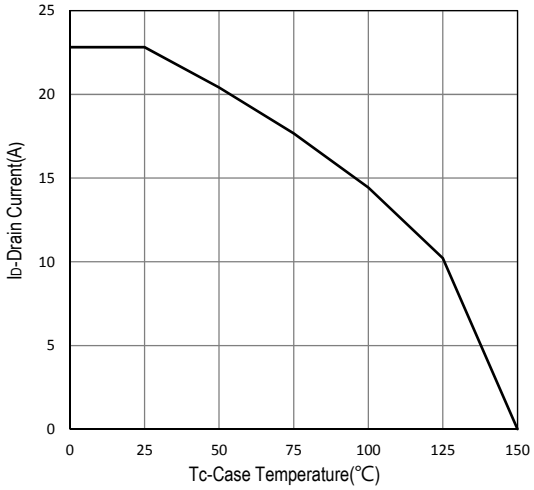


Typical Operating Characteristics (Cont.)

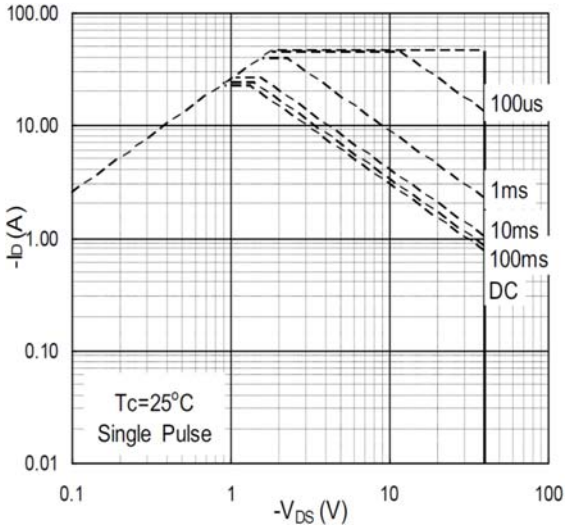
Power Dissipation



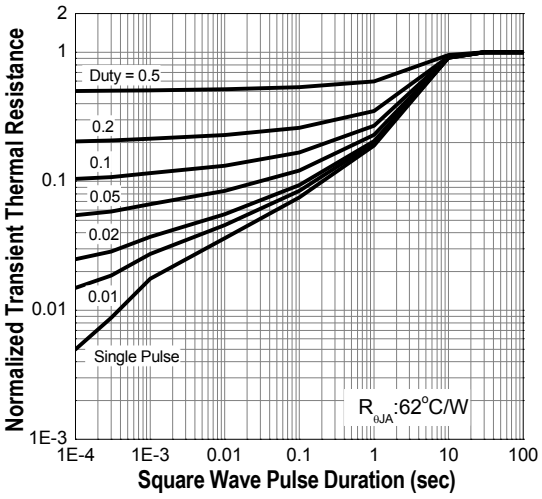
Drain Current



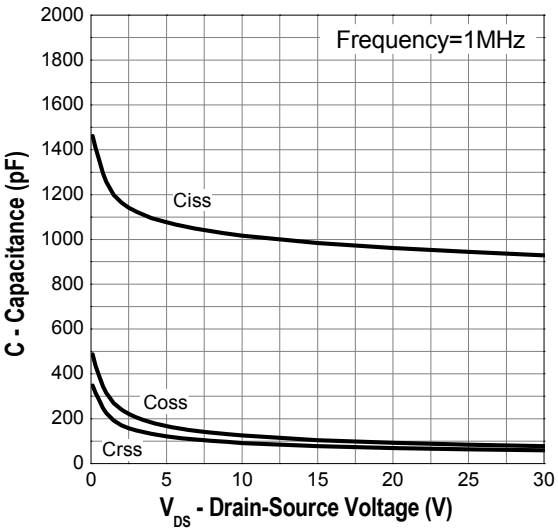
Safe Operation Area



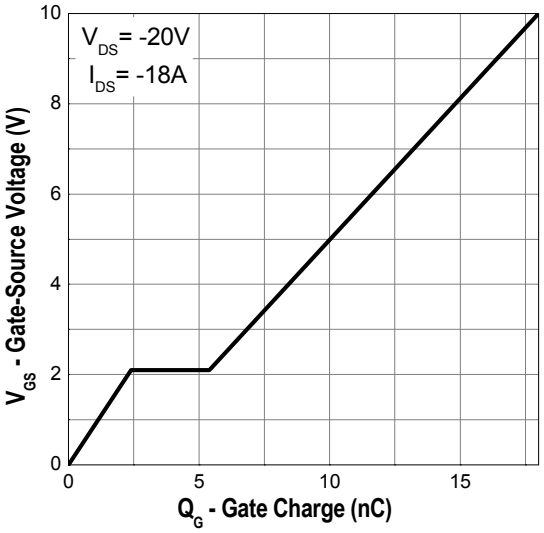
Transient Thermal Impedance



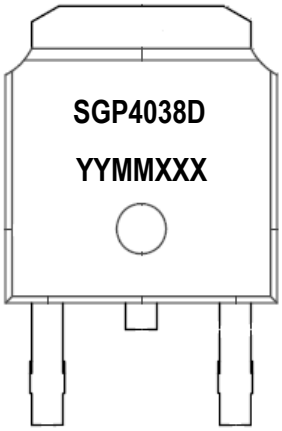
Capacitance



Gate Charge



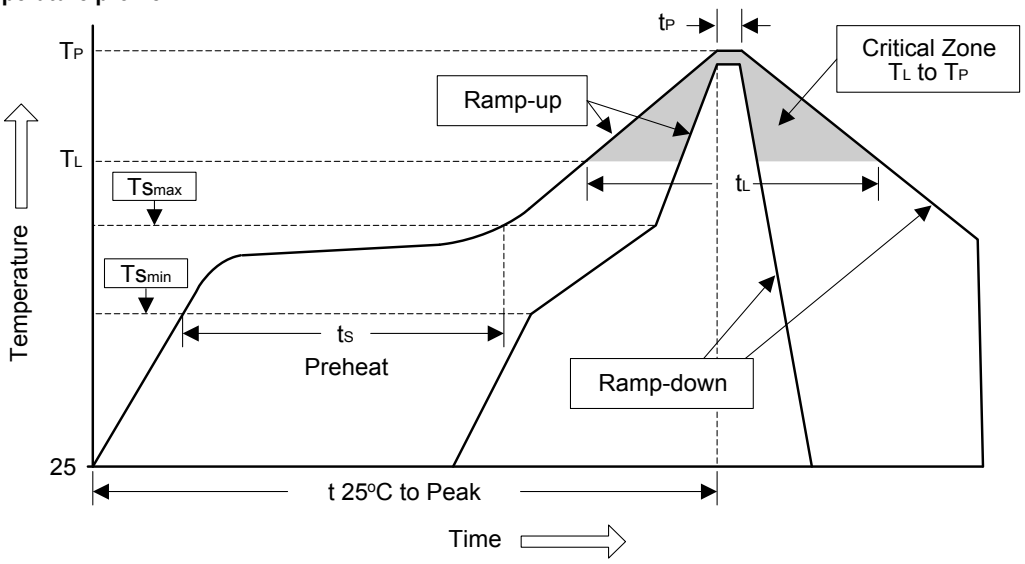
Marking Information

TO-252 (D)	Marking Rule
Laser Marking  	Line 1：Device SGP4038D Line 2：Date Code YYMMXXX YY：Year Code MM：Month Code XXX：Serial Number

Soldering Methods for Silicongear'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 (Ts_{min}) - Temperature Max (Ts_{max}) - Time (min to max) (ts)	 100°C 150°C 60 to 120 sec	 150°C 200°C 60 to 180 sec
Tsmax to T_L - Ramp-up Rate	 <3°C/sec	 <3°C/sec
Time maintained above: - Temperature (T_L) - Time (t_L)	 183°C 60 to 150 sec	 217°C 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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