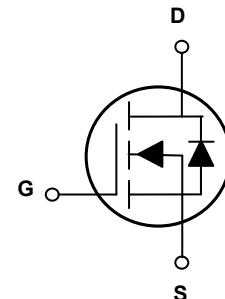
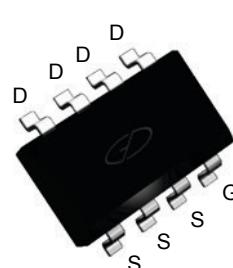


## Main Product Characteristics

BV(DSS)	30V
R <sub>DS(ON)</sub>	4.2mΩ
I <sub>D</sub>	30A



## Features and Benefits

SOP-8

Schematic Diagram

- Advanced MOSFET process technology
- Ideal for high efficiency switched mode power supplies
- Low on-resistance with low gate charge
- Fast switching and reverse body recovery



## Description

The GSFQ3904 utilizes the latest techniques to achieve high cell density and low on-resistance. These features make this device extremely efficient and reliable for use in high efficiency switch mode power supply and a wide variety of other applications.

## Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Max.	Unit
Drain-Source Voltage	V <sub>DS</sub>	30	V
Gate-Source Voltage	V <sub>GS</sub>	±20	V
Drain Current-Continuous ( $T_C=25^\circ\text{C}$ )	I <sub>D</sub>	30	A
Drain Current-Continuous ( $T_C=100^\circ\text{C}$ )		19	
Drain Current-Pulsed <sup>1</sup>	I <sub>DM</sub>	120	A
Single Pulse Avalanche Energy <sup>2</sup>	E <sub>AS</sub>	125	mJ
Single Pulse Avalanche Current <sup>2</sup>	I <sub>AS</sub>	50	A
Power Dissipation ( $T_C=25^\circ\text{C}$ )	P <sub>D</sub>	7	W
Power Dissipation-Derate above 25°C		0.056	W/°C
Thermal Resistance, Junction-to-Ambient	R <sub>θJA</sub>	62	°C/W
Thermal Resistance, Junction-to-Case	R <sub>θJC</sub>	18	°C/W
Operating Junction Temperature Range	T <sub>J</sub>	-55 To +175	°C
Storage Temperature Range	T <sub>STG</sub>	-55 To +175	°C

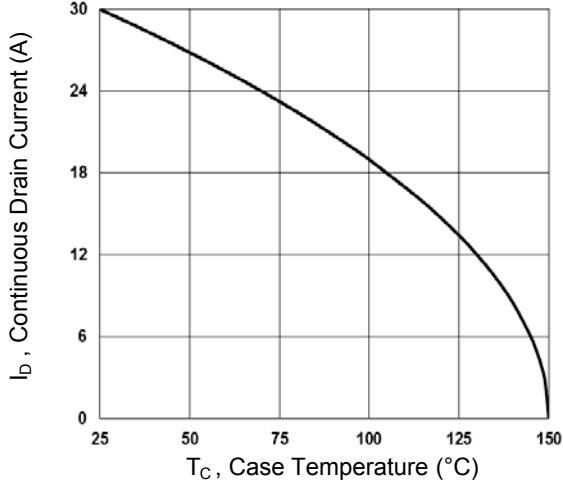
### Electrical Characteristics ( $T_J=25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>On/Off Characteristics</b>						
Drain-Source Breakdown Voltage	$\text{BV}_{\text{DSS}}$	$\text{V}_{\text{GS}}=0\text{V}, \text{I}_D=250\mu\text{A}$	30	-	-	V
$\text{BV}_{\text{DSS}}$ Temperature Coefficient	$\Delta \text{BV}_{\text{DSS}}/\Delta T_J$	Reference to $25^\circ\text{C}$ , $\text{I}_D=1\text{mA}$	-	0.03	-	$\text{mV}^\circ\text{C}$
Drain-Source Leakage Current	$\text{I}_{\text{DS}(0)}$	$\text{V}_{\text{DS}}=30\text{V},$ $\text{V}_{\text{GS}}=0\text{V}, \text{T}_J=25^\circ\text{C}$	-	-	1	$\mu\text{A}$
		$\text{V}_{\text{DS}}=24\text{V}, \text{V}_{\text{GS}}=0\text{V},$ $\text{T}_J=125^\circ\text{C}$	-	-	10	$\mu\text{A}$
Gate-Source Leakage Current	$\text{I}_{\text{GSS}}$	$\text{V}_{\text{GS}}=\pm 20\text{V}, \text{V}_{\text{DS}}=0\text{V}$	-	-	$\pm 100$	nA
Static Drain-Source On-Resistance <sup>3</sup>	$\text{R}_{\text{DS}(\text{ON})}$	$\text{V}_{\text{GS}}=10\text{V}, \text{I}_D=12\text{A}$	-	3.8	4.2	$\text{m}\Omega$
		$\text{V}_{\text{GS}}=4.5\text{V}, \text{I}_D=6\text{A}$	-	5.2	6	$\text{m}\Omega$
Gate Threshold Voltage	$\text{V}_{\text{GS}(\text{th})}$	$\text{V}_{\text{GS}}=\text{V}_{\text{DS}}, \text{I}_D=250\mu\text{A}$	1.2	1.6	2.5	V
$\text{V}_{\text{GS}(\text{th})}$ Temperature Coefficient	$\Delta \text{V}_{\text{GS}(\text{th})}$		-	-5	-	$\text{mV}^\circ\text{C}$
Forward Transconductance	$\text{g}_{\text{fs}}$	$\text{V}_{\text{DS}}=10\text{V}, \text{I}_D=6\text{A}$	-	12	-	S
<b>Dynamic and Switching Characteristics</b>						
Total Gate Charge <sup>3,4</sup>	$\text{Q}_g$	$\text{V}_{\text{DS}}=15\text{V},$ $\text{I}_D=12\text{A},$ $\text{V}_{\text{GS}}=4.5\text{V}$	-	24	34	nC
Gate-Source Charge <sup>3,4</sup>	$\text{Q}_{\text{gs}}$		-	4.2	6	
Gate-Drain Charge <sup>3,4</sup>	$\text{Q}_{\text{gd}}$		-	13	18	
Turn-On Delay Time <sup>3,4</sup>	$\text{t}_{\text{d}(\text{on})}$	$\text{V}_{\text{DD}}=15\text{V}, \text{R}_G=3.3\Omega,$ $\text{V}_{\text{GS}}=10\text{V}, \text{I}_D=15\text{A}$	-	12.6	24	nS
Rise Time <sup>3,4</sup>	$\text{t}_r$		-	19.5	37	
Turn-Off Delay Time <sup>3,4</sup>	$\text{t}_{\text{d}(\text{off})}$		-	42.8	81	
Fall Time <sup>3,4</sup>	$\text{t}_f$		-	13.2	25	
Input Capacitance	$\text{C}_{\text{iss}}$		-	2200	3190	
Output Capacitance	$\text{C}_{\text{oss}}$	$\text{V}_{\text{DS}}=25\text{V},$ $\text{V}_{\text{GS}}=0\text{V}, F=1\text{MHz}$	-	280	405	pF
Reverse Transfer Capacitance	$\text{C}_{\text{rss}}$		-	177	255	
Gate Resistance	$\text{R}_g$		$\text{V}_{\text{GS}}=0\text{V}, \text{V}_{\text{DS}}=0\text{V},$ $F=1\text{MHz}$	-	2	$\Omega$
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Single Pulse Avalanche Energy	$\text{E}_{\text{AS}}$	$\text{V}_{\text{DD}}=25\text{V}, L=0.1\text{mH},$ $\text{I}_{\text{AS}}=10\text{A}$	31	-	-	mJ
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Continuous Source Current	$\text{I}_s$	$\text{V}_G=\text{V}_D=0\text{V},$ Force Current	-	-	30	A
Pulsed Source Current <sup>3</sup>	$\text{I}_{\text{SM}}$		-	-	120	A
Diode Forward Voltage <sup>3</sup>	$\text{V}_{\text{SD}}$	$\text{V}_{\text{GS}}=0\text{V},$ $\text{I}_s=1\text{A}, \text{T}_J=25^\circ\text{C}$	-	-	1	V

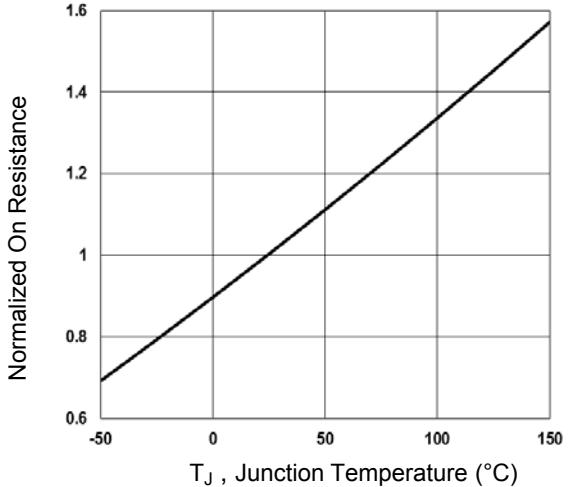
Note:

1. Repetitive rating: Pulsed width limited by maximum junction temperature.
2.  $\text{V}_{\text{DD}}=25\text{V}, \text{V}_{\text{GS}}=10\text{V}, L=0.1\text{mH}, \text{I}_{\text{AS}}=50\text{A}, \text{R}_G=25\Omega$ , starting  $\text{T}_J=25^\circ\text{C}$ .
3. Pulse test: pulse width  $\leq 300\text{us}$ , duty cycle  $\leq 2\%$ .
4. Essentially independent of operation temperature.

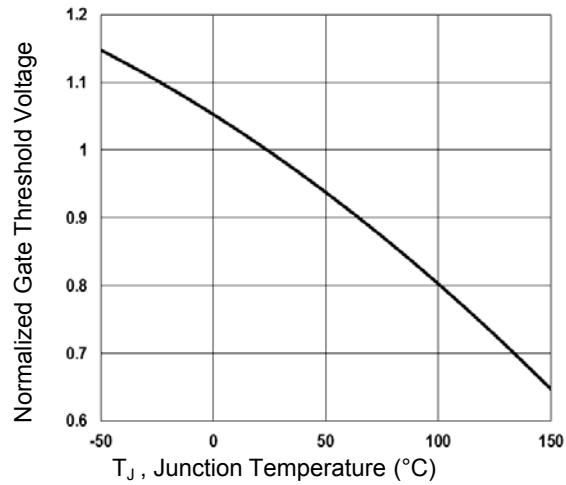
## Typical Electrical and Thermal Characteristic Curves



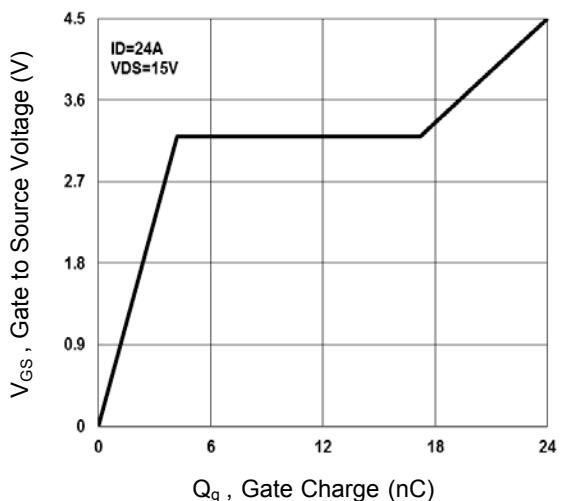
**Figure 1. Continuous Drain Current vs. T<sub>c</sub>**



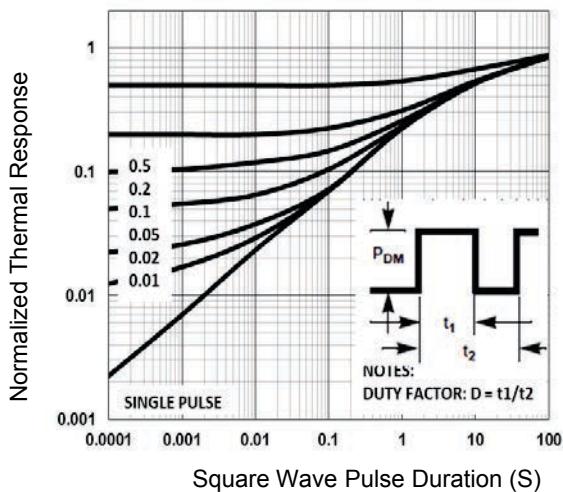
**Figure 2. Normalized R<sub>DS(ON)</sub> vs. T<sub>j</sub>**



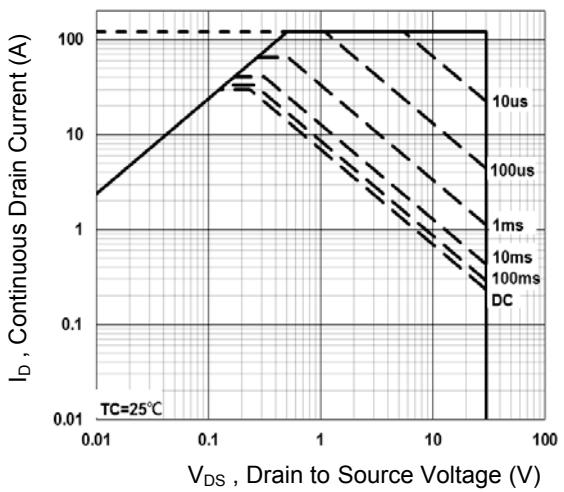
**Figure 3. Normalized V<sub>th</sub> vs. T<sub>j</sub>**



**Figure 3. Gate Charge Waveform**



**Figure 5. Normalized Transient Impedance**



**Figure 6. Maximum Safe Operation Area**

## Typical Electrical and Thermal Characteristic Curves

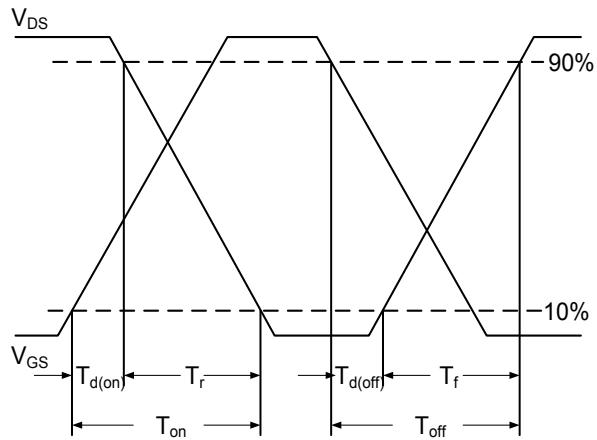


Figure 7 Switching Time Waveform

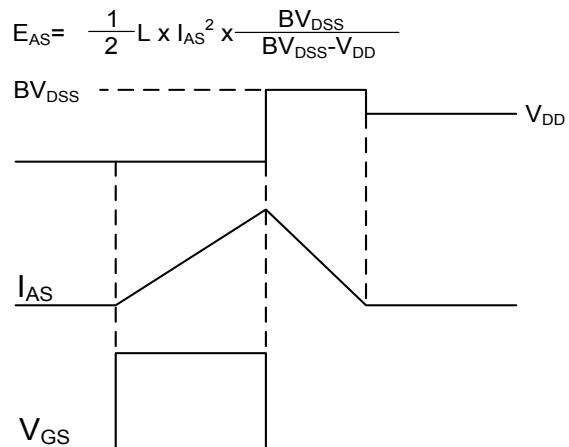
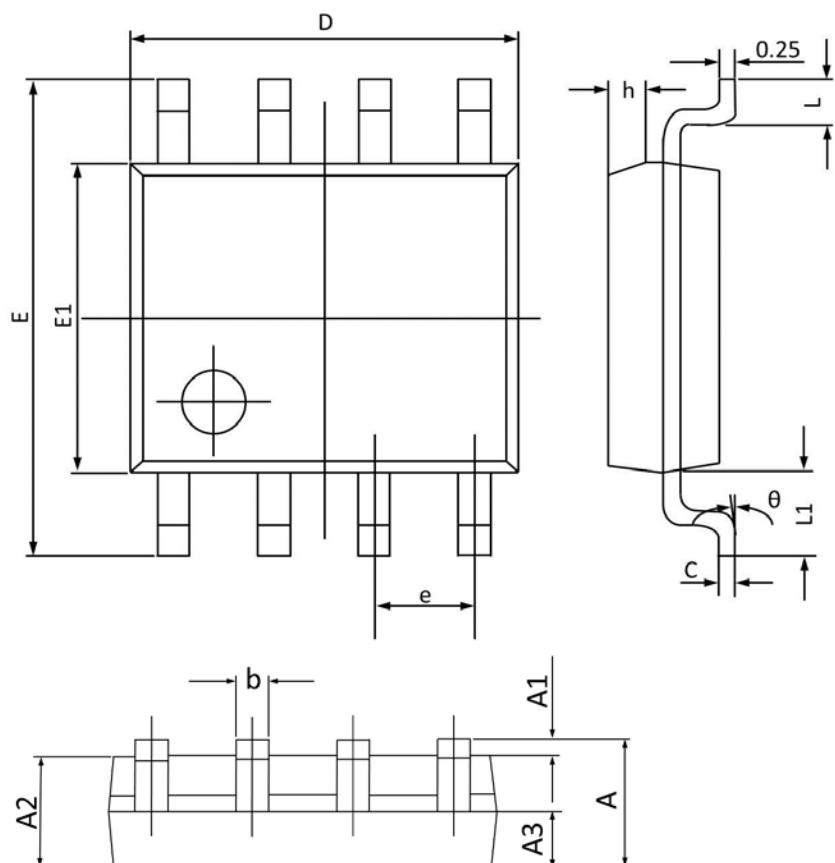


Figure 8. EAS Waveform

## Package Outline Dimensions

SOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.068
A1	0.100	0.250	0.004	0.009
A2	1.300	1.500	0.052	0.059
A3	0.600	0.700	0.024	0.027
b	0.390	0.480	0.016	0.018
c	0.210	0.260	0.009	0.010
D	4.700	5.100	0.186	0.200
E	5.800	6.200	0.229	0.244
E1	3.700	4.100	0.146	0.161
e	1.270(BSC)		0.050(BSC)	
h	0.250	0.500	0.010	0.019
L	0.500	0.800	0.019	0.031
L1	1.050(BSC)		0.041(BSC)	
θ	0°	8°	0°	8°