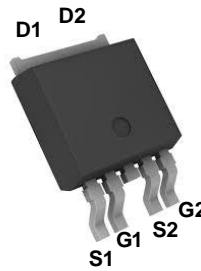
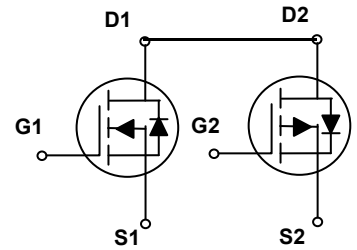


### Main Product Characteristics

$V_{(BR)DSS}$	40V	-40V
$R_{DS(ON)}$	32m $\Omega$	40m $\Omega$
$I_D$	15A	-12A



TO-252-4L



Schematic Diagram

### Features and Benefits

- 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

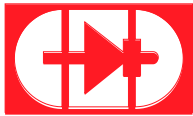


### Description

The GSFD04C16 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	$V_{DS}$	40	-40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Drain Current-Continuous ( $T_C=25^\circ\text{C}$ )	$I_D$	15	-12	A
Drain Current-Continuous ( $T_C=100^\circ\text{C}$ )		9.0	-7.0	A
Drain Current-Pulsed <sup>1</sup>	$I_{DM}$	60	-48	A
Power Dissipation ( $T_C=25^\circ\text{C}$ )	$P_D$	20		W
Power Dissipation-Derate Above 25 $^\circ\text{C}$		0.16		W/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	6.0		$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	62.0		$^\circ\text{C}/\text{W}$
Storage Temperature Range	$T_{STG}$	-50 To +150		$^\circ\text{C}$
Operating Junction Temperature Range	$T_J$	-50 To +150		$^\circ\text{C}$

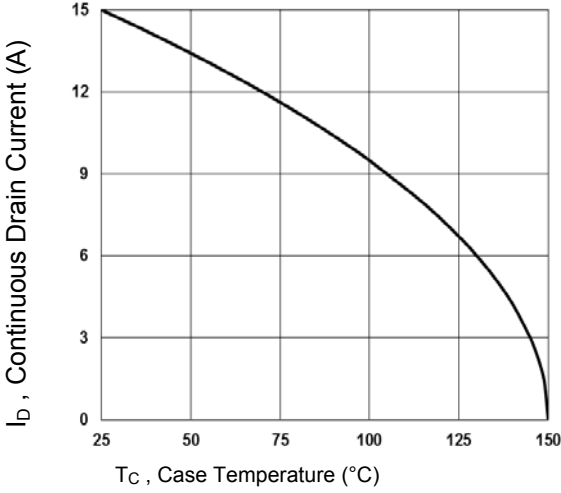

**N-Channel Electrical Characteristics** ( $T_J=25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	40	-	-	V
$BV_{DSS}$ Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	Reference to $25^\circ\text{C}$ , $I_D=1mA$	-	0.04	-	$V/^\circ\text{C}$
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=40V, V_{GS}=0V,$ $T_J=25^\circ\text{C}$	-	-	1	$\mu A$
		$V_{DS}=32V, V_{GS}=0V,$ $T_J=125^\circ\text{C}$	-	-	10	$\mu A$
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
Static Drain-Source On-Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=6A$	-	26	32	m $\Omega$
		$V_{GS}=4.5V, I_D=4A$	-	36	42	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2	1.6	2.5	V
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}$		-	-3.0	-	$mV/^\circ\text{C}$
Forward Transconductance	$g_{FS}$	$V_{DS}=10V, I_D=3A$	-	6.5	-	S
<b>Dynamic and Switching Characteristics</b>						
Total Gate Charge <sup>2,3</sup>	$Q_g$	$V_{DS}=20V, I_D=6A,$ $V_{GS}=4.5V$	-	5.2	10.0	nC
Gate-Source Charge <sup>2,3</sup>	$Q_{gs}$		-	1.2	2.4	
Gate-Drain Charge <sup>2,3</sup>	$Q_{gd}$		-	2.5	5.0	
Turn-On Delay Time <sup>2,3</sup>	$t_{d(on)}$	$V_{DD}=20V, R_G=25\Omega$ $V_{GS}=4.5V, I_D=1A$	-	3.2	6.0	nS
Rise Time <sup>2,3</sup>	$t_r$		-	8.6	16	
Turn-Off Delay Time <sup>2,3</sup>	$t_{d(off)}$		-	18.0	36	
Fall Time <sup>2,3</sup>	$t_f$		-	6.0	12.0	
Input Capacitance	$C_{iss}$	$V_{DS}=15V, V_{GS}=0V,$ $F=1MHz$	-	420	800	PF
Output Capacitance	$C_{oss}$		-	65	120	
Reverse Transfer Capacitance	$C_{rss}$		-	40	80	
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Continuous Source Current	$I_S$	$V_G=V_D=0V,$ Force Current	-	-	15	A
Pulsed Source Current	$I_{SM}$		-	-	30	A
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=1A,$ $T_J=25^\circ\text{C}$	-	-	1	V

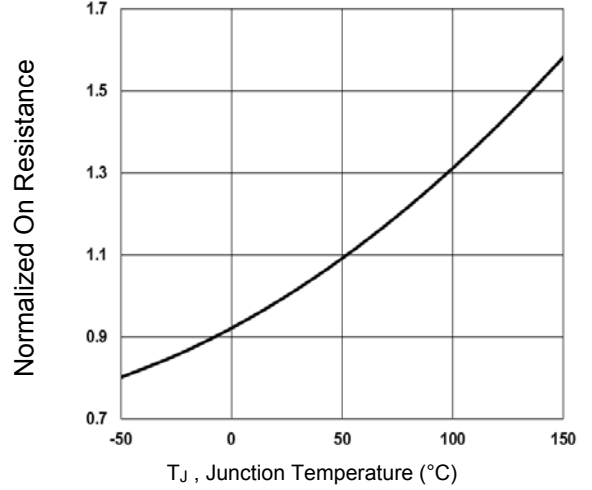
Note:

1. Repetitive Rating: Pulsed width limited by maximum junction temperature.
2. Pulse test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
3. Essentially independent of operating temperature.

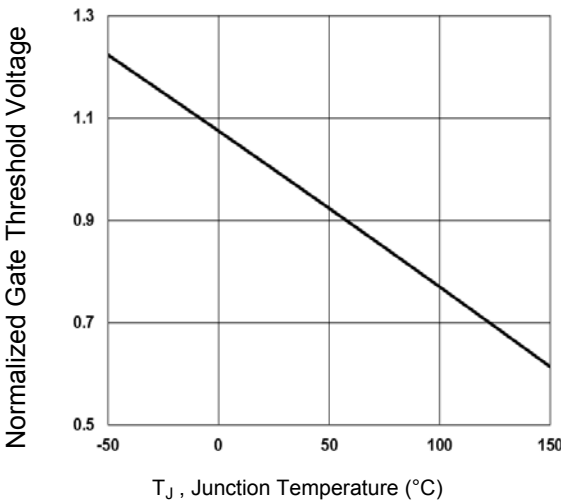
## N-Channel Typical Electrical and Thermal Characteristic Curves



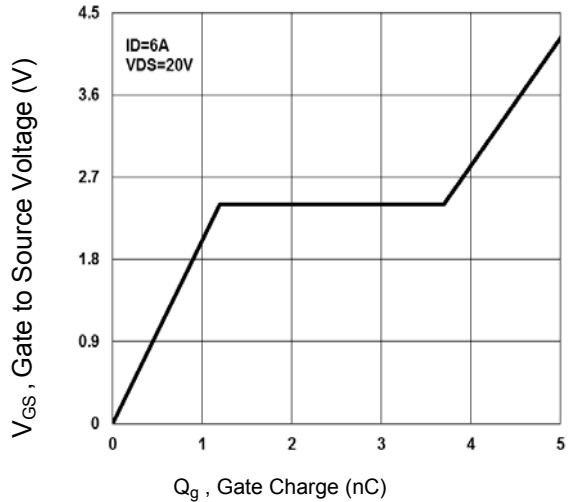
**Fig.1** Continuous Drain Current vs.  $T_C$



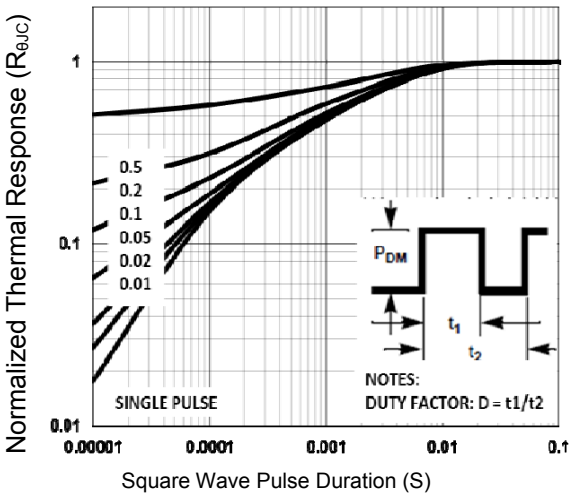
**Fig.2** Normalized  $R_{DS(ON)}$  vs.  $T_J$



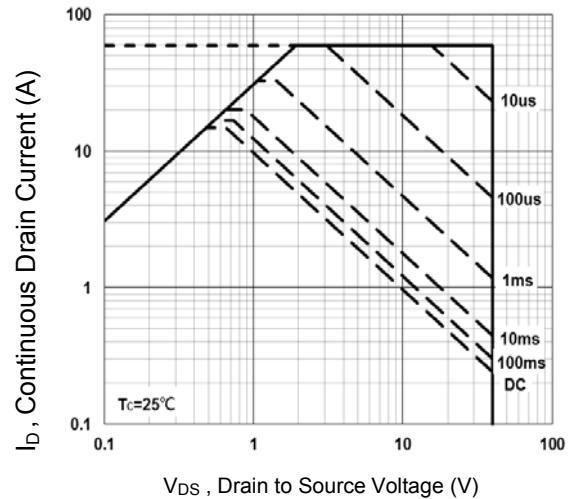
**Fig.3** Normalized  $V_{th}$  vs.  $T_J$



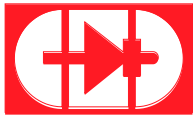
**Fig.4** Gate Charge Waveform



**Fig.5** Normalized Transient Impedance



**Fig.6** Maximum Safe Operation Area

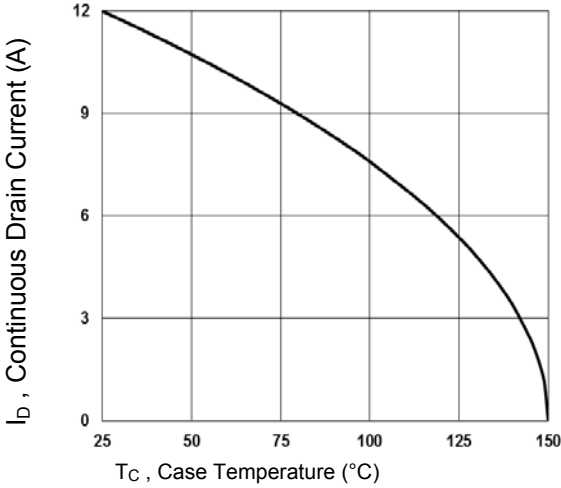

**P-Channel Electrical Characteristics** ( $T_J=25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-40	-	-	V
$BV_{DSS}$ Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	Reference to $25^\circ\text{C}$ , $I_D=-1mA$	-	-0.04	-	$V/^\circ\text{C}$
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=-40V, V_{GS}=0V,$ $T_J=25^\circ\text{C}$	-	-	-1	$\mu A$
		$V_{DS}=-32V, V_{GS}=0V,$ $T_J=125^\circ\text{C}$	-	-	-10	$\mu A$
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
Static Drain-Source On-Resistance	$R_{DS(ON)}$	$V_{GS}=-10V, I_D=-5A$	-	30	40	m $\Omega$
		$V_{GS}=-4.5V, I_D=-3A$	-	42	52	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.2	-1.6	-2.5	V
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}$		-	3.0	-	$mV/^\circ\text{C}$
Forward Transconductance	$g_{FS}$	$V_{DS}=-10V, I_D=-3A$	-	9.0	-	S
<b>Dynamic and Switching Characteristics</b>						
Total Gate Charge <sup>2,3</sup>	$Q_g$	$V_{DS}=-20V, I_D=-5A,$ $V_{GS}=-4.5V$	-	9.0	15.0	nC
Gate-Source Charge <sup>2,3</sup>	$Q_{gs}$		-	2.5	5.0	
Gate-Drain Charge <sup>2,3</sup>	$Q_{gd}$		-	3.2	7.0	
Turn-On Delay Time <sup>2,3</sup>	$t_{d(on)}$	$V_{DD}=-20V, R_G=25\Omega$ $V_{GS}=-4.5V, I_D=-1A$	-	20	40	nS
Rise Time <sup>2,3</sup>	$t_r$		-	12	24	
Turn-Off Delay Time <sup>2,3</sup>	$t_{d(off)}$		-	46	80	
Fall Time <sup>2,3</sup>	$t_f$		-	6.0	12.0	
Input Capacitance	$C_{iss}$	$V_{DS}=-15V, V_{GS}=0V,$ $F=1MHz$	-	1050	1600	PF
Output Capacitance	$C_{oss}$		-	110	160	
Reverse Transfer Capacitance	$C_{rss}$		-	80	120	
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Continuous Source Current	$I_S$	$V_G=V_D=0V,$ Force Current	-	-	-12	A
Pulsed Source Current	$I_{SM}$		-	-	-24	A
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=-1A,$ $T_J=25^\circ\text{C}$	-	-	-1	V

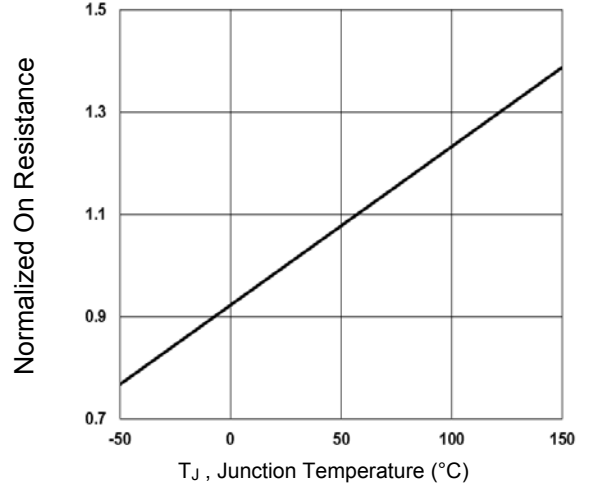
Note:

1. Repetitive Rating: Pulsed width limited by maximum junction temperature.
2. Pulse test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
3. Essentially independent of operating temperature.

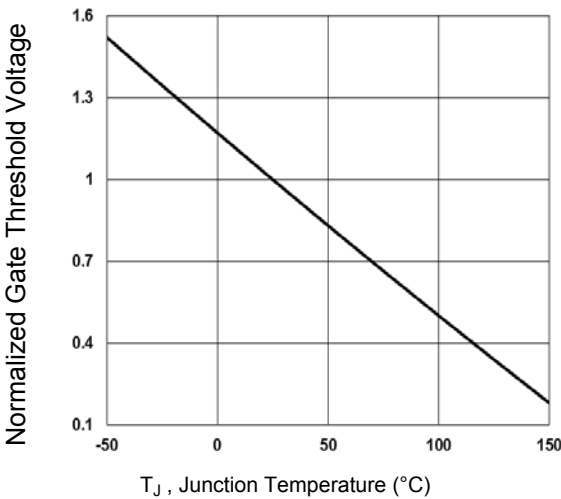
### P-Channel Typical Electrical and Thermal Characteristic Curves



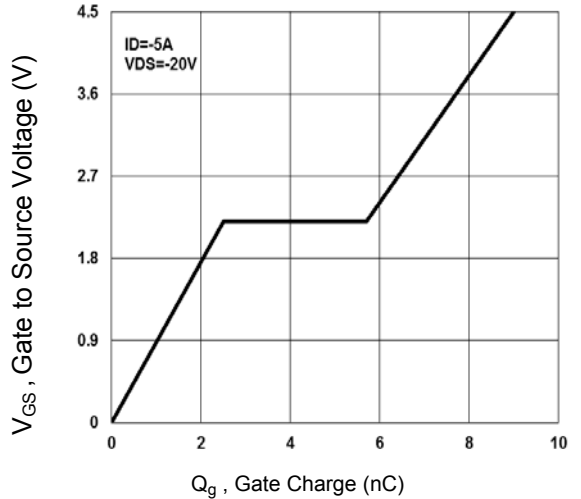
**Fig.7 Continuous Drain Current vs. Tc**



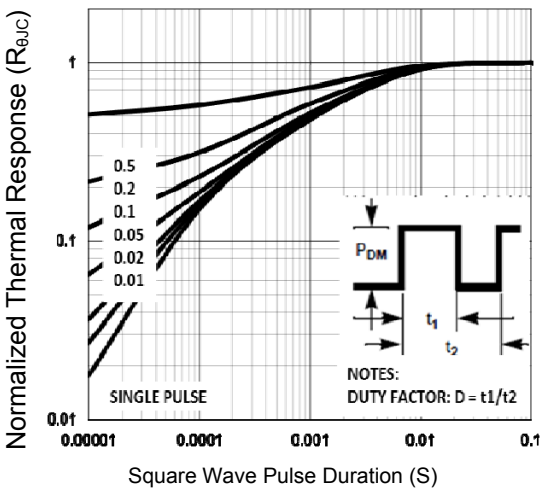
**Fig.8 Normalized  $R_{DS(ON)}$  vs.  $T_J$**



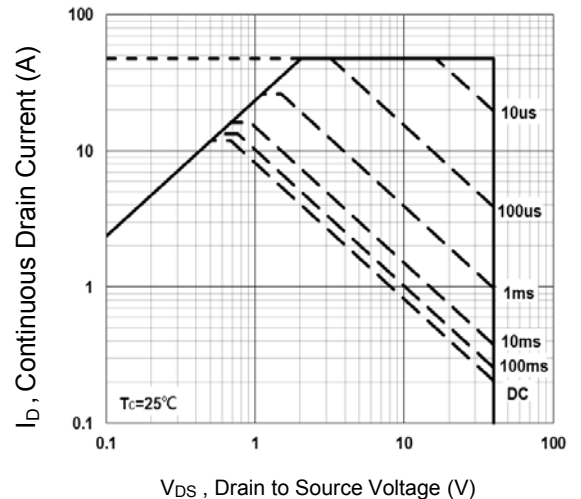
**Fig.9 Normalized  $V_{th}$  vs.  $T_J$**



**Fig.10 Gate Charge Waveform**

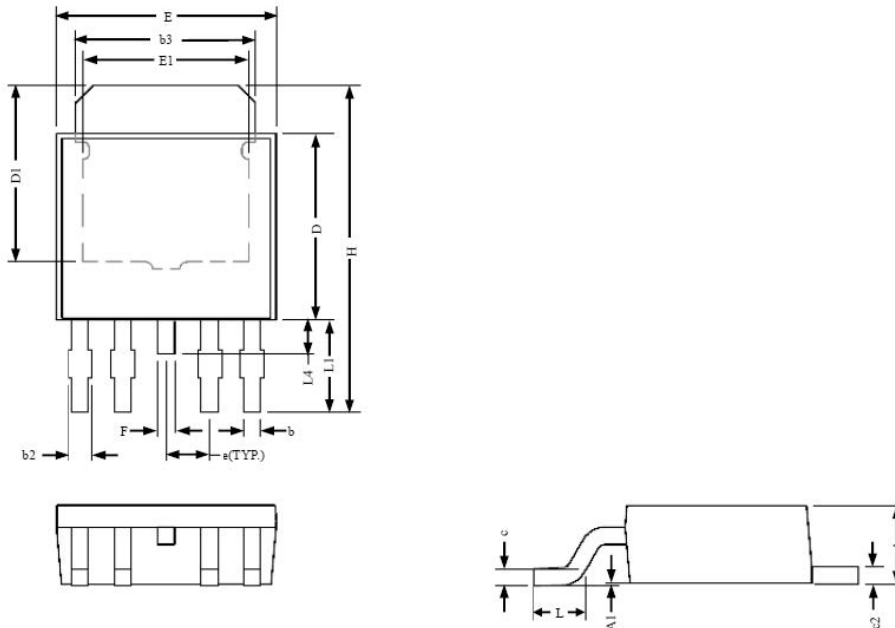


**Fig.11 Normalized Transient Impedance**



**Fig.12 Maximum Safe Operation Area**

## Package Outline Dimensions TO-252-4L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MAX	MIN	MAX	MIN
A	2.400	2.200	0.094	0.087
A1	0.150	0.000	0.006	0.000
B	0.600	0.400	0.024	0.016
b2	0.800	0.500	0.031	0.020
b3	5.500	5.200	0.217	0.205
C	0.508typ.		0.02typ.	
c2	0.550	0.450	0.022	0.018
D	5.800	5.400	0.228	0.213
D1	---	4.570	---	0.180
E	6.800	6.400	0.268	0.252
E1	---	3.810	---	0.150
E	1.27ref.		0.05ref.	
F	0.600	0.400	0.024	0.016
H	10.200	9.400	0.402	0.370
L	1.770	1.400	0.070	0.055
L1	3.000	2.400	0.118	0.094
L4	1.200	0.800	0.047	0.031