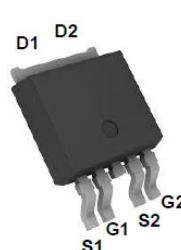
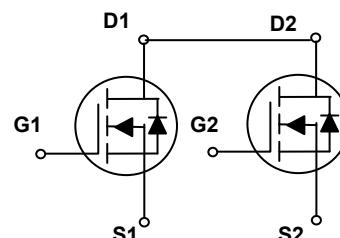


### Main Product Characteristics

Channel	N	P
$V_{(BR)DSS}$	40V	-40V
$R_{DS(ON)}$	$V_{GS}=10V$	$V_{GS}=-10V$
	$\leq 28m\Omega$	$\leq 40m\Omega$
$I_D$	23A	-20A



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 GSFD4040C 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 supplies and a wide variety of other applications.

### Absolute Maximum Ratings ( $T_A=25^\circ C$ unless otherwise specified)

Parameter	Symbol	Rating		Unit
		N-Ch	P-Ch	
Drain-Source Voltage	$V_{DS}$	40	-40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Drain Current-Continuous, at Steady-State, ( $T_A=25^\circ C$ ) <sup>1</sup>	$I_D$	23	-20	A
Drain Current-Continuous, at Steady-State, ( $T_A=100^\circ C$ ) <sup>1</sup>	$I_D$	18	-16	A
Drain Current-Pulsed <sup>2</sup>	$I_{DM}$	46	-40	A
Single Pulse Avalanche Energy <sup>3</sup>	$E_{AS}$	28	66	mJ
Power Dissipation <sup>4</sup>	$P_D$	25	31.3	W
Junction-to-Ambient (PCB Mounted, Steady-State) <sup>1</sup>	$R_{\theta JA}$	62		$^\circ C/W$
Operating Junction Temperature Range	$T_J$	$-55 \text{ To } +150$		$^\circ C$
Storage Temperature Range	$T_{STG}$	$-55 \text{ To } +150$		$^\circ C$

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>On / Off Characteristics</b>						
Drain-Source Breakdown Voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}}=0\text{V}, I_D=250\mu\text{A}$	40	-	-	V
Drain-Source Leakage Current	$I_{\text{DSS}}$	$V_{\text{DS}}=32\text{V}, V_{\text{GS}}=0\text{V}$	-	-	1	$\mu\text{A}$
Gate-Source Forward Leakage	$I_{\text{GSS}}$	$V_{\text{DS}}=0\text{V}, V_{\text{GS}}=20\text{V}$	-	-	100	$\text{nA}$
		$V_{\text{DS}}=0\text{V}, V_{\text{GS}}=-20\text{V}$	-	-	-100	
Static Drain-Source On-Resistance <sup>2</sup>	$R_{\text{DS}(\text{on})}$	$V_{\text{GS}}=10\text{V}, I_D=12\text{A}$	-	-	28	$\text{m}\Omega$
		$V_{\text{GS}}=4.5\text{V}, I_D=10\text{A}$	-	-	42	
Gate Threshold Voltage	$V_{\text{GS}(\text{th})}$	$V_{\text{GS}}=V_{\text{DS}}, I_D=250\mu\text{A}$	1	1.5	2.5	V
Forward Transconductance	$g_{\text{fs}}$	$V_{\text{DS}}=5\text{V}, I_D=12\text{A}$	-	8	-	S
<b>Dynamic and Switching Characteristics</b>						
Total Gate Charge	$Q_g$	$V_{\text{DS}}=20\text{V}, I_D=12\text{A}$ $V_{\text{GS}}=4.5\text{V}$	-	5.5	-	$\text{nC}$
Gate-Source Charge	$Q_{\text{gs}}$		-	1.25	-	
Gate-Drain ("Miller") Charge	$Q_{\text{gd}}$		-	2.5	-	
Turn-On Delay Time	$t_{\text{d}(\text{on})}$	$V_{\text{DS}}=20\text{V}, R_G=3.3\Omega$ $V_{\text{GS}}=10\text{V}, I_D=1\text{A}$	-	8.9	-	$\text{nS}$
Rise Time	$t_r$		-	2.2	-	
Turn-Off Delay Time	$t_{\text{d}(\text{off})}$		-	41	-	
Fall Time	$t_f$		-	2.7	-	
Input Capacitance	$C_{\text{iss}}$	$V_{\text{DS}}=15\text{V}, V_{\text{GS}}=0\text{V},$ $F=1\text{MHz}$	-	593	-	$\text{pF}$
Output Capacitance	$C_{\text{oss}}$		-	76	-	
Reverse Transfer Capacitance	$C_{\text{rss}}$		-	56	-	
Gate Resistance	$R_g$	$V_{\text{GS}}=0\text{V}, V_{\text{DS}}=0\text{V},$ $F=1\text{MHz}$	-	2.6	5.2	$\Omega$
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Continuous Source Current (Body Diode) <sup>1,5</sup>	$I_s$	MOSFET symbol showing the integral reverse p-n junction diode.	-	-	23	A
Diode Forward Voltage <sup>2</sup>	$V_{\text{SD}}$	$V_{\text{GS}}=0\text{V}, I_s=1\text{A}$	-	-	1.2	V

Note:

- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
- 2.Pulse test: pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- 3.The  $E_{\text{AS}}$  data shows Max. rating. The test condition is  $V_{\text{DD}}=25\text{V}, V_{\text{GS}}=10\text{V}, L=0.1\text{mH}$ .
- 4.The power dissipation is limited by  $150^\circ\text{C}$  junction temperature.
- 5.The data is theoretically the same as  $I_D$  and  $I_{\text{DM}}$ , in real applications, should be limited by total power dissipation.

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>On / Off Characteristics</b>						
Drain-Source Breakdown Voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}}=0\text{V}, I_D=-250\mu\text{A}$	-40	-	-	V
Drain-Source Leakage Current	$I_{\text{DSS}}$	$V_{\text{DS}}=-32\text{V}, V_{\text{GS}}=0\text{V}$	-	-	1	$\mu\text{A}$
Gate-Source Forward Leakage	$I_{\text{GSS}}$	$V_{\text{DS}}=0\text{V}, V_{\text{GS}}=20\text{V}$	-	-	100	nA
		$V_{\text{DS}}=0\text{V}, V_{\text{GS}}=-20\text{V}$	-	-	-100	
Static Drain-Source On-Resistance <sup>2</sup>	$R_{\text{DS}(\text{ON})}$	$V_{\text{GS}}=-10\text{V}, I_D=-8\text{A}$	-	-	40	$\text{m}\Omega$
		$V_{\text{GS}}=-4.5\text{V}, I_D=-4\text{A}$	-	-	65	
Gate Threshold Voltage	$V_{\text{GS}(\text{th})}$	$V_{\text{GS}}=V_{\text{DS}}, I_D=-250\mu\text{A}$	-1	-1.6	-2.5	V
Forward Transconductance	$g_{\text{fs}}$	$V_{\text{DS}}=-5\text{V}, I_D=-8\text{A}$	-	12.6	-	S
<b>Dynamic and Switching Characteristics</b>						
Total Gate Charge	$Q_g$	$V_{\text{DS}}=-20\text{V}, I_D=-12\text{A}$ $V_{\text{GS}}=-4.5\text{V}$	-	9	-	nC
Gate-Source Charge	$Q_{\text{gs}}$		-	2.54	-	
Gate-Drain ("Miller") Charge	$Q_{\text{gd}}$		-	3.1	-	
Turn-On Delay Time	$t_{\text{d}(\text{on})}$	$V_{\text{DS}}=-15\text{V}, R_G=3.3\Omega$ $V_{\text{GS}}=-10\text{V}, I_D=-1\text{A}$	-	19.2	-	nS
Rise Time	$t_r$		-	12.8	-	
Turn-Off Delay Time	$t_{\text{d}(\text{off})}$		-	48.6	-	
Fall Time	$t_f$		-	4.6	-	
Input Capacitance	$C_{\text{iss}}$	$V_{\text{DS}}=-15\text{V}, V_{\text{GS}}=0\text{V},$ $F=1\text{MHz}$	-	1004	-	pF
Output Capacitance	$C_{\text{oss}}$		-	108	-	
Reverse Transfer Capacitance	$C_{\text{rss}}$		-	80	-	
Gate Resistance	$R_g$	$V_{\text{GS}}=0\text{V}, V_{\text{DS}}=0\text{V},$ $F=1\text{MHz}$	-	13	16	$\Omega$
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Continuous Source Current (Body Diode) <sup>1,5</sup>	$I_s$	MOSFET symbol showing the integral reverse p-n junction diode.	-	-	-20	A
Diode Forward Voltage <sup>2</sup>	$V_{\text{SD}}$	$V_{\text{GS}}=0\text{V}, I_s=-1\text{A}$	-	-	-1	V

Note:

- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
- 2.Pulse test: pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- 3.The EAS data shows Max. rating. The test condition is  $V_{\text{DD}}=-25\text{V}, V_{\text{GS}}=-10\text{V}, L=0.1\text{mH}$ .
- 4.The power dissipation is limited by  $150^\circ\text{C}$  junction temperature.
- 5.The data is theoretically the same as  $I_D$  and  $I_{\text{DM}}$ , in real applications, should be limited by total power dissipation.

## N-Channel Typical Electrical and Thermal Characteristic Curves

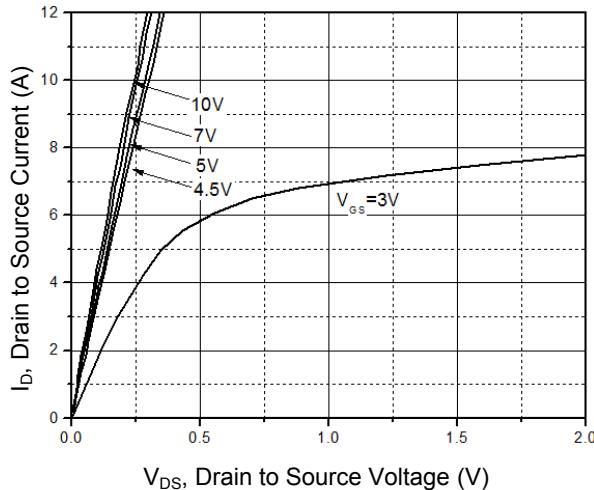


Figure 1. Typical Output Characteristics

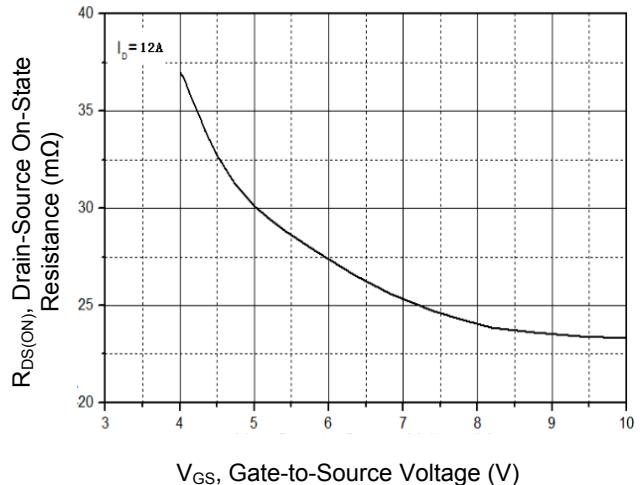


Figure 2. On-Resistance vs. G-S Voltage

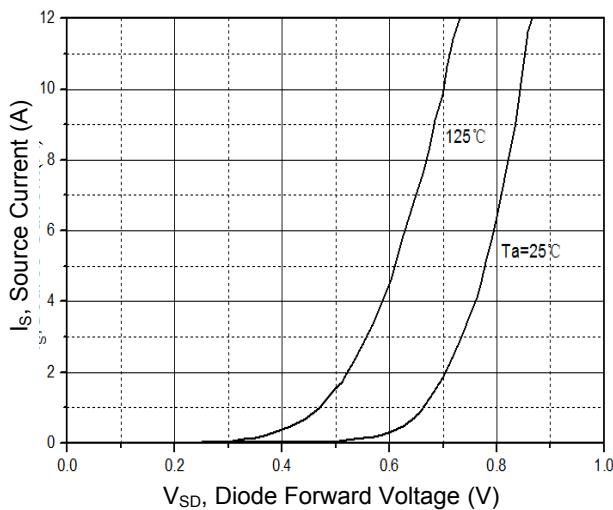


Figure 3. Forward Characteristics of Reverse

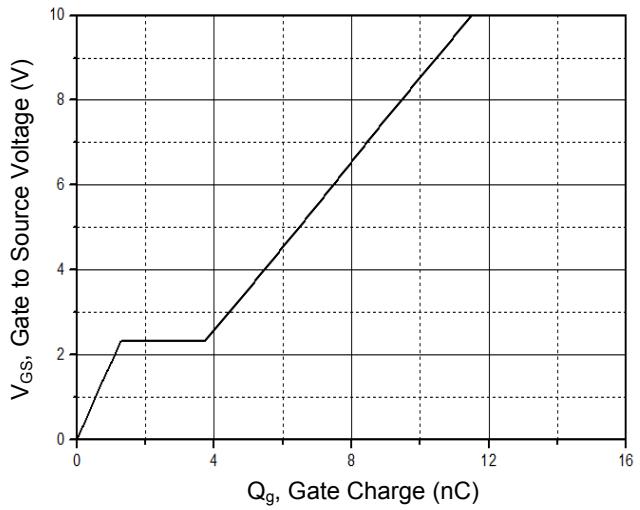


Figure 4. Gate Charge

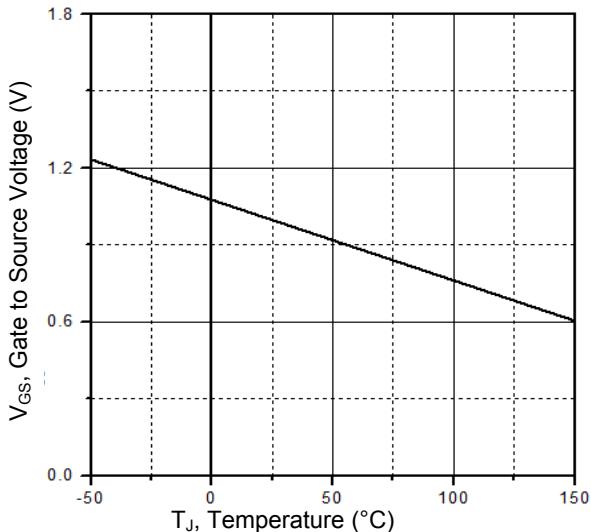


Figure 5. Normalized  $V_{GS(th)}$  vs.  $T_J$

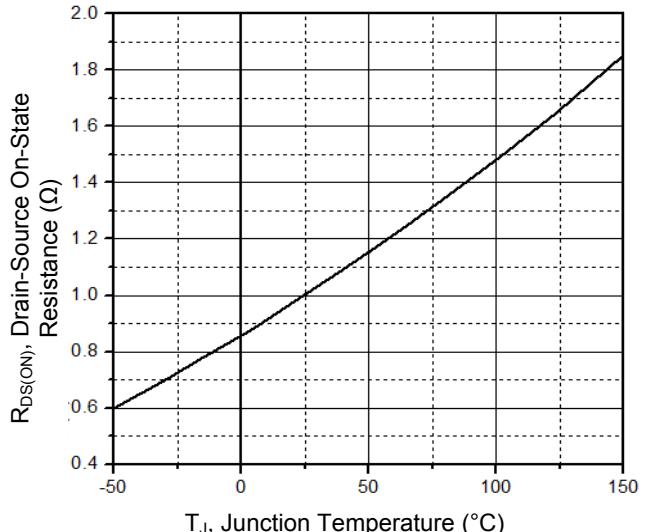


Figure 6. Normalized  $R_{DS(on)}$  vs.  $T_J$

## N-Channel Typical Electrical and Thermal Characteristic Curves

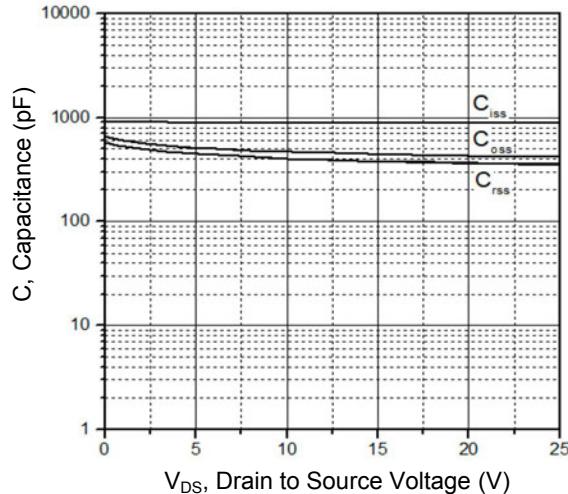


Figure 7. Capacitance Characteristics

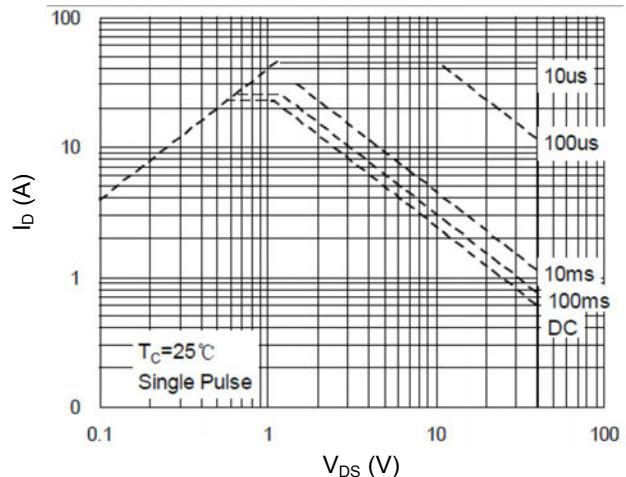


Figure 8. Safe Operating Area

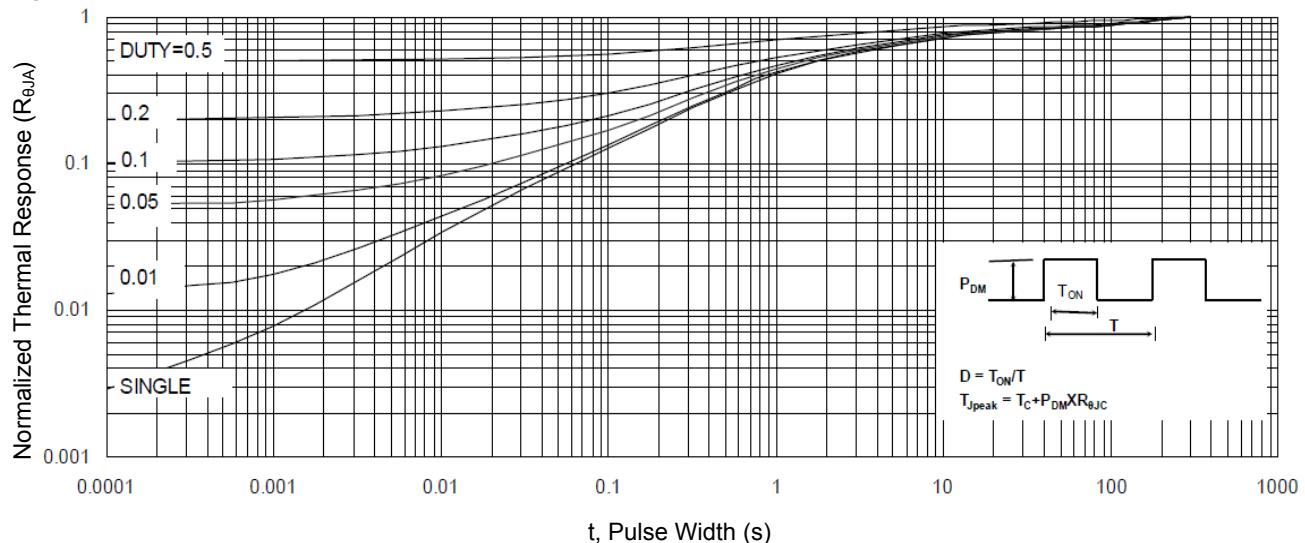


Figure 9. Normalized Maximum Transient Thermal Impedance

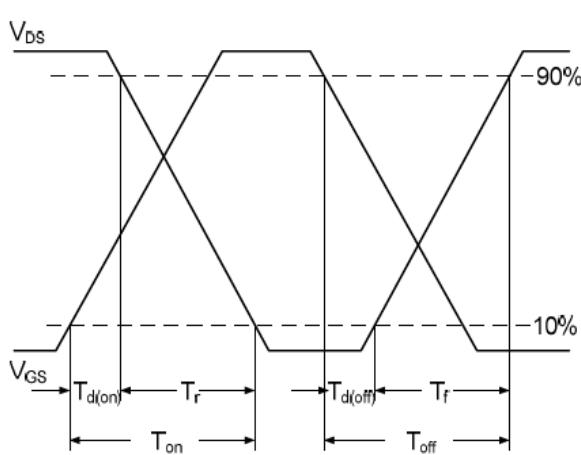


Figure 10. Switching Time Waveform

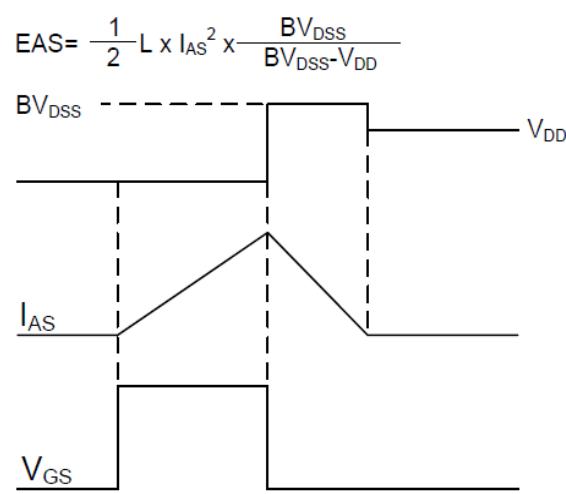


Figure 11. Unclamped Inductive Switching Waveform

## P-Channel Typical Electrical and Thermal Characteristic Curves

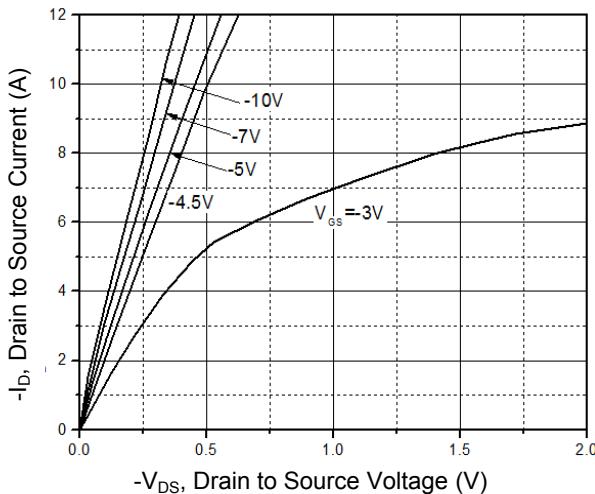


Figure 1. Output Characteristics

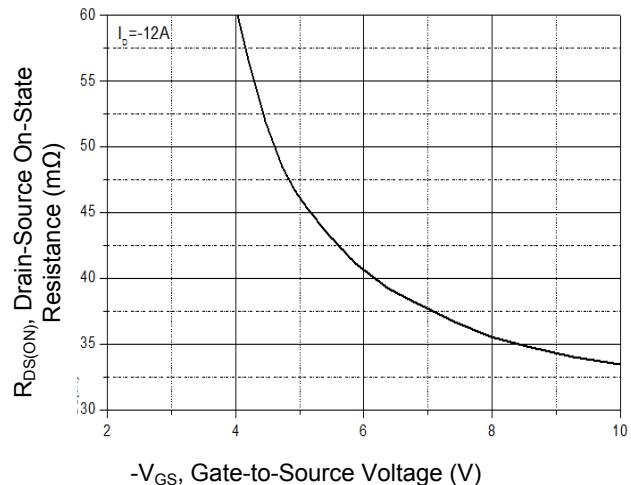


Figure 2. On-Resistance vs. G-S Voltage

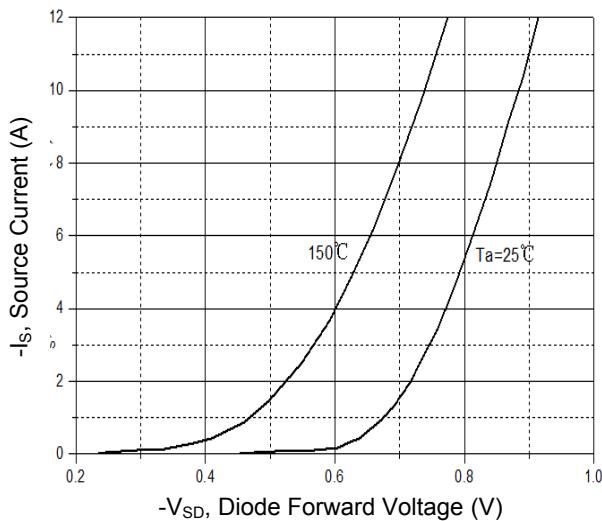


Figure 3. Forward Characteristics of Reverse

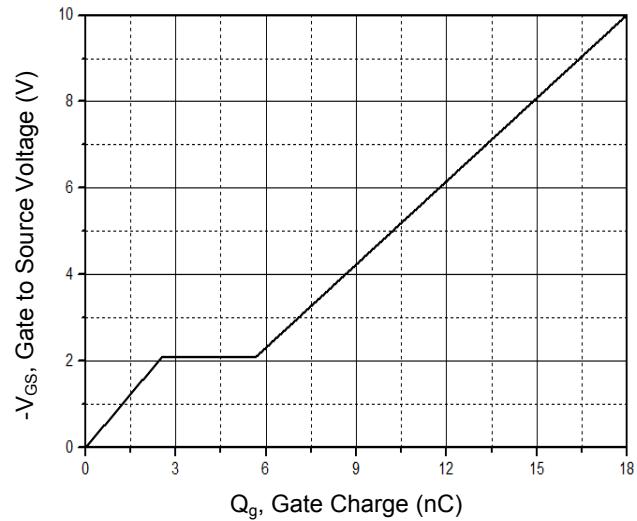


Figure 4. Gate Charge

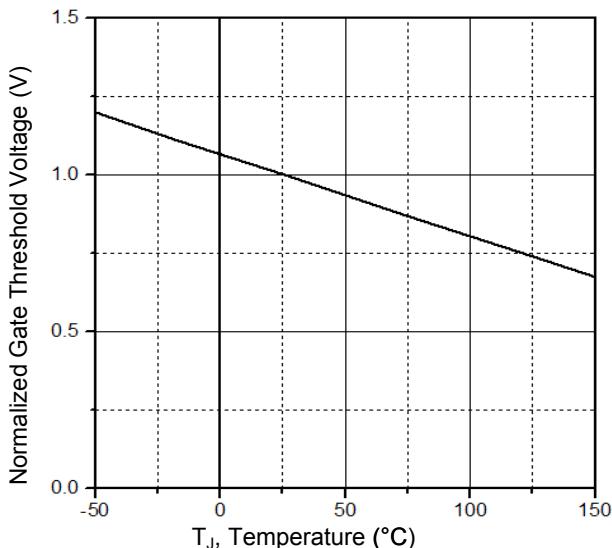


Figure 5. Normalized  $V_{GS(th)}$  vs.  $T_J$

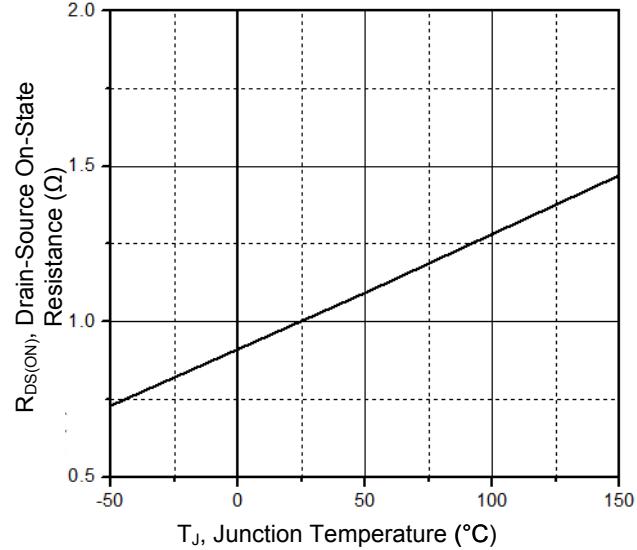


Figure 6. Normalized  $R_{DS(ON)}$  vs.  $T_J$

## P-Channel Typical Electrical and Thermal Characteristic Curves

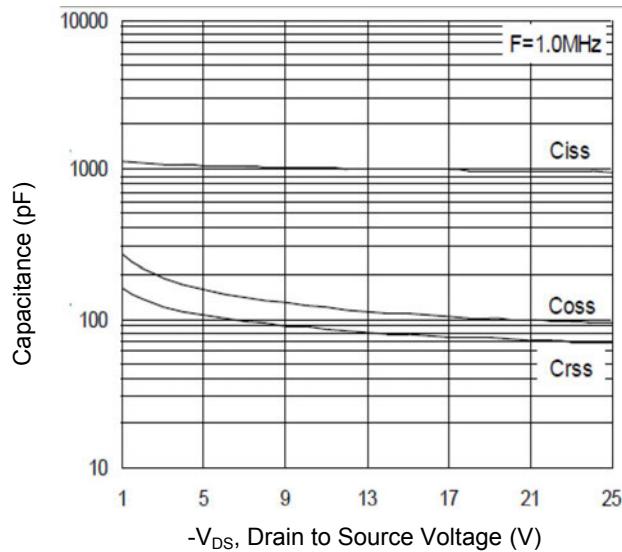


Figure 7. Capacitance Characteristics

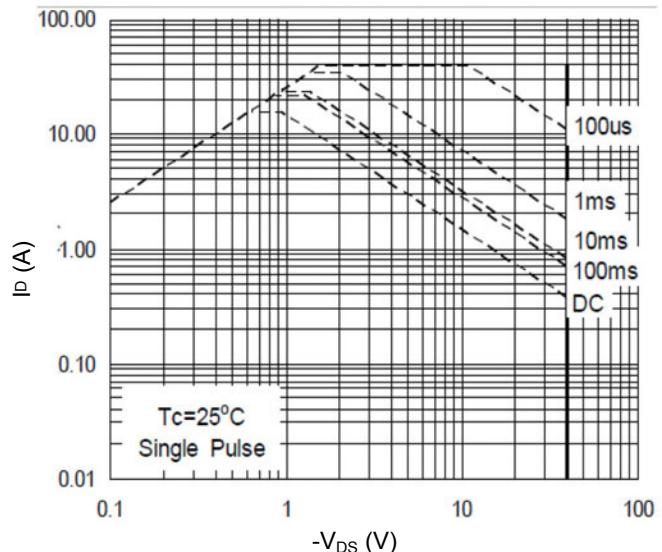


Figure 8. Safe Operating Area

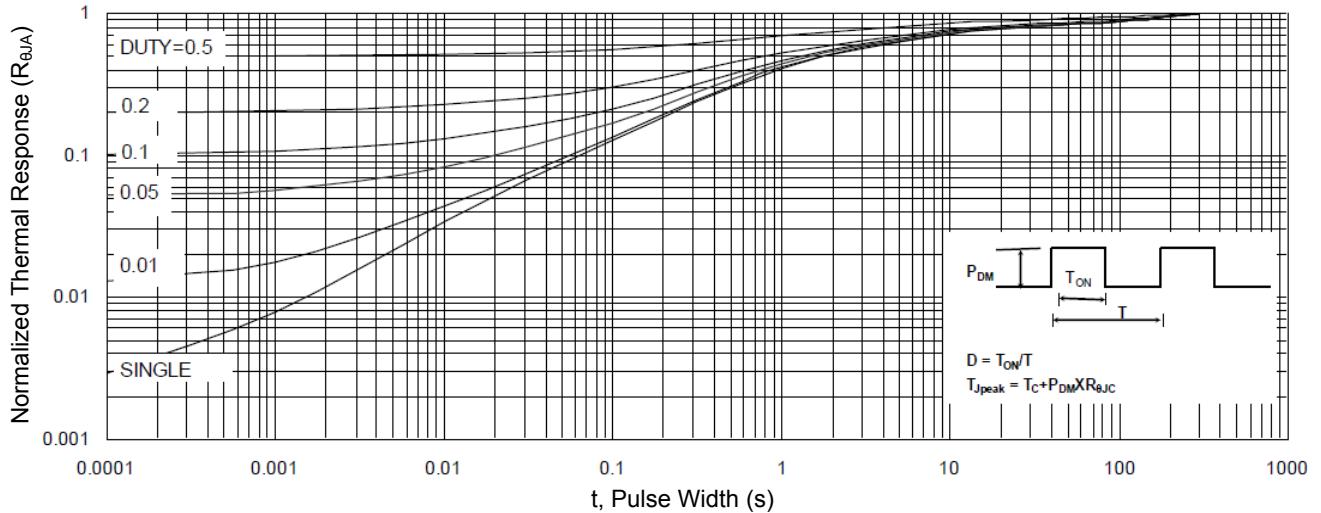


Figure 9. Normalized Maximum Transient Thermal Impedance

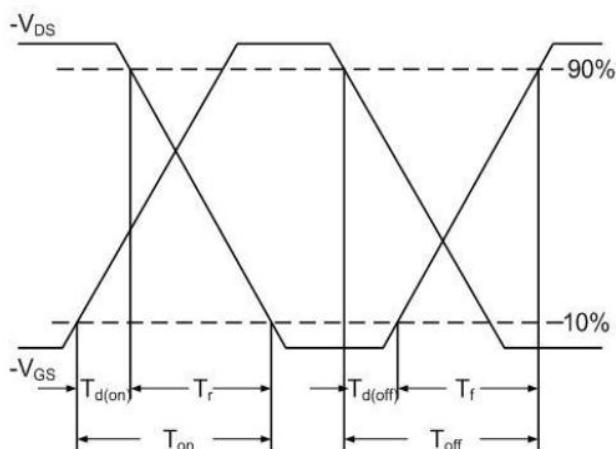


Figure 10. Switching Time Waveform

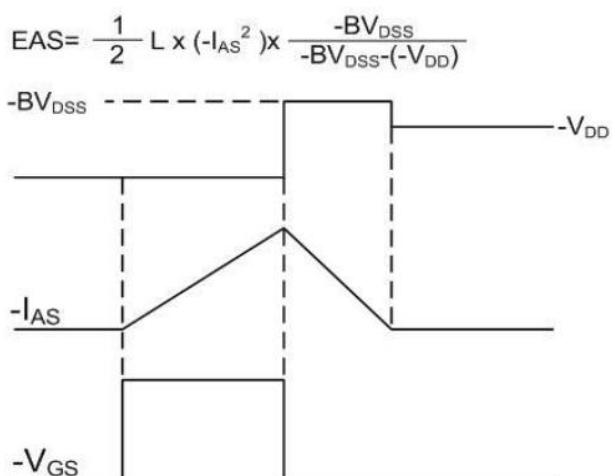
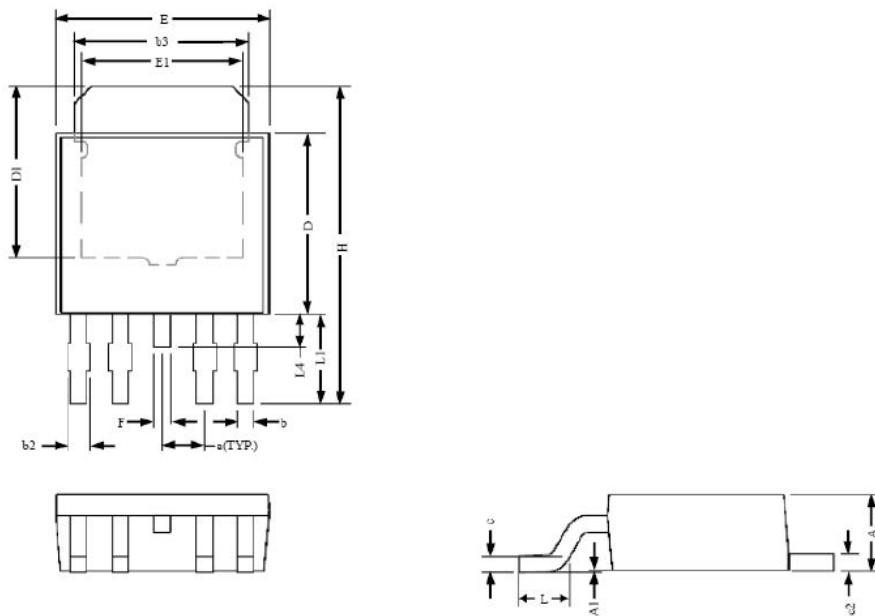


Figure 11. Unclamped Inductive Switching Waveform

### Package Outline Dimensions (TO-252-4L)



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