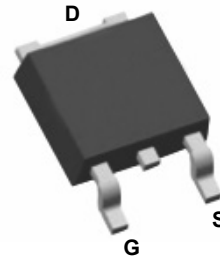
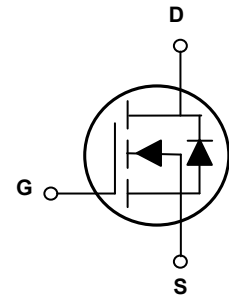


### Main Product Characteristics

$BV_{DSS}$	60V
$R_{DS(ON)}$	12m $\Omega$
$I_D$	45A



TO-252 (DPAK)



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 GSFD0646 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	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous ( $T_C=25^\circ\text{C}$ )	$I_D$	45	A
Drain Current-Continuous ( $T_C=100^\circ\text{C}$ )		28	
Drain Current-Pulsed <sup>1</sup>	$I_{DM}$	180	A
Single Pulse Avalanche Energy <sup>2</sup>	$E_{AS}$	61	mJ
Single Pulse Avalanche Current <sup>2</sup>	$I_{AS}$	35	A
Power Dissipation ( $T_C=25^\circ\text{C}$ )	$P_D$	63	W
Power Dissipation-Derate above $25^\circ\text{C}$		0.5	
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	62	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	2	$^\circ\text{C}/\text{W}$
Operating Junction Temperature Range	$T_J$	-55 To +150	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-55 To +150	$^\circ\text{C}$

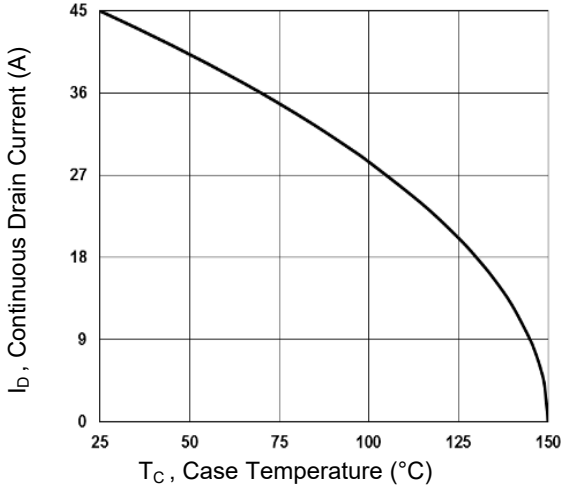
**Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$  unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>On/Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	60	-	-	V
$BV_{DSS}$ Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	Reference to $25^{\circ}\text{C}$ , $I_D=1\text{mA}$	-	0.03	-	$V/^{\circ}\text{C}$
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=60V, V_{GS}=0V,$ $T_J=25^{\circ}\text{C}$	-	-	1	$\mu A$
		$V_{DS}=48V, V_{GS}=0V,$ $T_J=85^{\circ}\text{C}$	-	-	10	$\mu A$
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
Static Drain-Source On-Resistance <sup>3</sup>	$R_{DS(ON)}$	$V_{GS}=10V, I_D=10A$	-	10	12	m $\Omega$
		$V_{GS}=4.5V, I_D=8A$	-	12	15	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	1.2	1.6	2.5	V
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}$		-	-4	-	mV/ $^{\circ}\text{C}$
Forward Transconductance	$g_{fs}$	$V_{DS}=10V, I_D=6A$	-	11.7	-	S
<b>Dynamic and Switching Characteristics</b>						
Total Gate Charge <sup>3,4</sup>	$Q_g$	$V_{DS}=30V,$ $I_D=10A, V_{GS}=10V$	-	39.2	59	nC
Gate-Source Charge <sup>3,4</sup>	$Q_{gs}$		-	5.9	9	
Gate-Drain Charge <sup>3,4</sup>	$Q_{gd}$		-	8.8	14	
Turn-On Delay Time <sup>3,4</sup>	$t_{d(on)}$	$V_{DD}=15V,$ $R_G=6\Omega$ $V_{GS}=10V, I_D=1A$	-	9.6	18	nS
Rise Time <sup>3,4</sup>	$t_r$		-	28.2	54	
Turn-Off Delay Time <sup>3,4</sup>	$t_{d(off)}$		-	45.3	86	
Fall Time <sup>3,4</sup>	$t_f$		-	10.9	21	
Input Capacitance	$C_{iss}$	$V_{DS}=25V,$ $V_{GS}=0V, F=1\text{MHz}$	-	2100	3050	pF
Output Capacitance	$C_{oss}$		-	165	240	
Reverse Transfer Capacitance	$C_{rss}$		-	80	120	
Gate Resistance	$R_g$	$V_{GS}=0V,$ $V_{DS}=0V, F=1\text{MHz}$	-	1.6	3.2	$\Omega$
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Continuous Source Current	$I_S$	$V_G=V_D=0V,$ Force Current	-	-	45	A
Pulsed Source Current <sup>3</sup>	$I_{SM}$		-	-	180	A
Diode Forward Voltage <sup>3</sup>	$V_{SD}$	$V_{GS}=0V,$ $I_S=1A, T_J=25^{\circ}\text{C}$	-	-	1	V

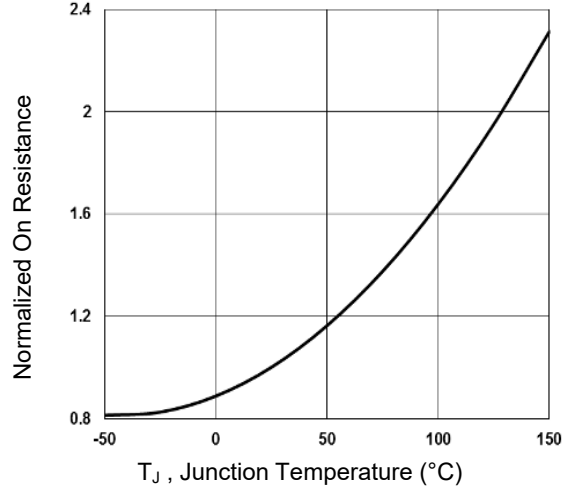
Note:

1. Repetitive rating: Pulsed width limited by maximum junction temperature.
2.  $V_{DD}=25V, V_{GS}=10V, L=0.1\text{mH}, I_{AS}=35A, R_G=25\Omega,$  starting  $T_J=25^{\circ}\text{C}$ .
3. Pulse test: pulse width  $\leq 300\mu s,$  duty cycle  $\leq 2\%$ .
4. Essentially independent of operating temperature.

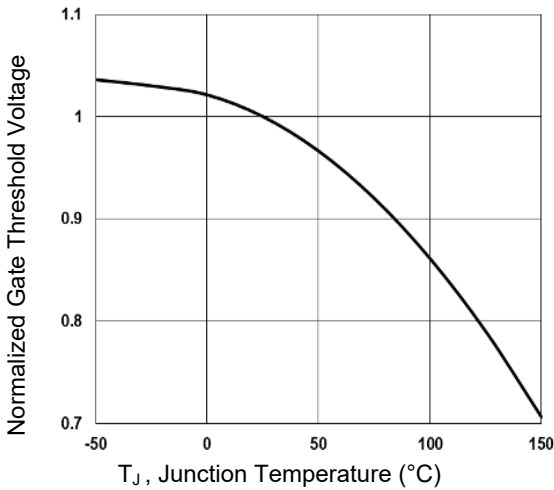
**Typical Electrical and Thermal Characteristic Curves**



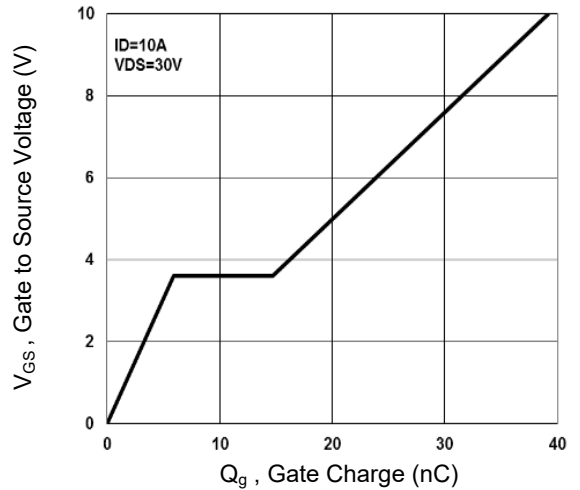
**Figure 1. Continuous Drain Current vs. T<sub>c</sub>**



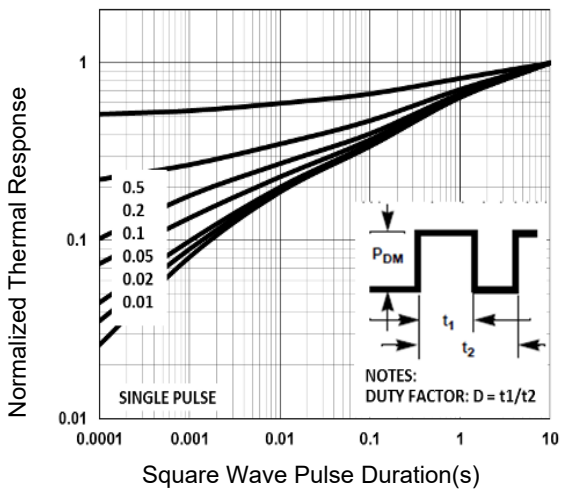
**Figure 2. Normalized R<sub>DS(on)</sub> vs. T<sub>j</sub>**



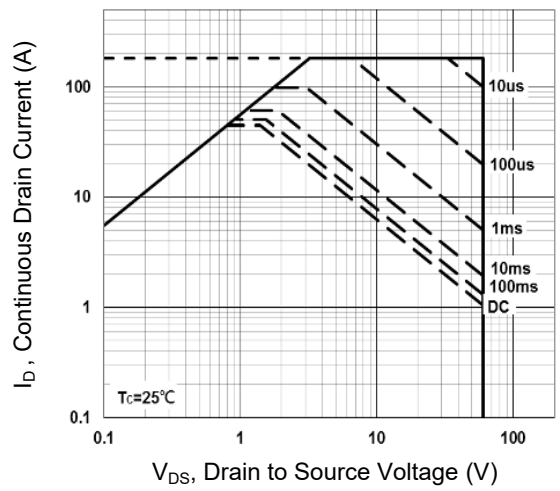
**Figure 3. Normalized V<sub>th</sub> vs. T<sub>j</sub>**



**Figure 4. Gate Charge Waveform**

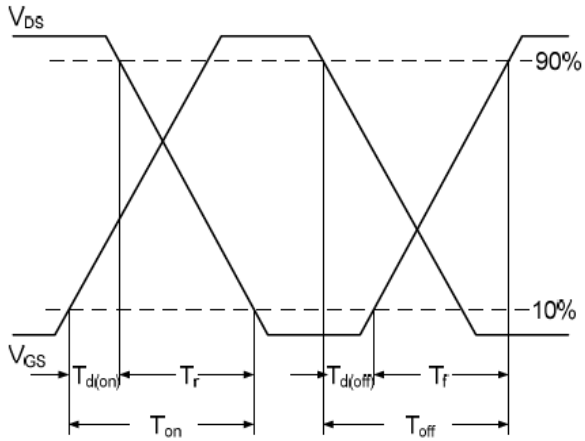


**Figure 5. Normalized Transient Response**

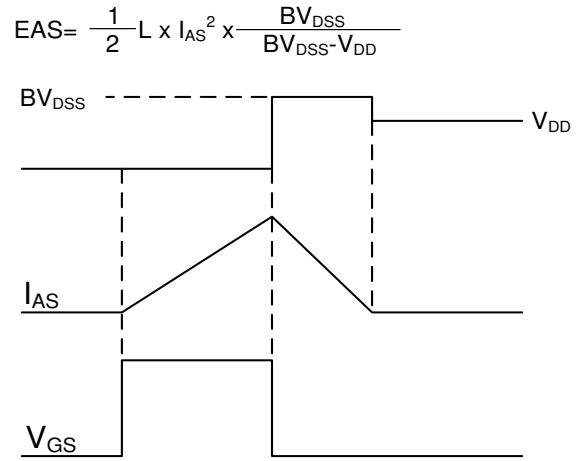


**Figure 6. Maximum Safe Operation Area**

**Typical Electrical and Thermal Characteristic Curves**

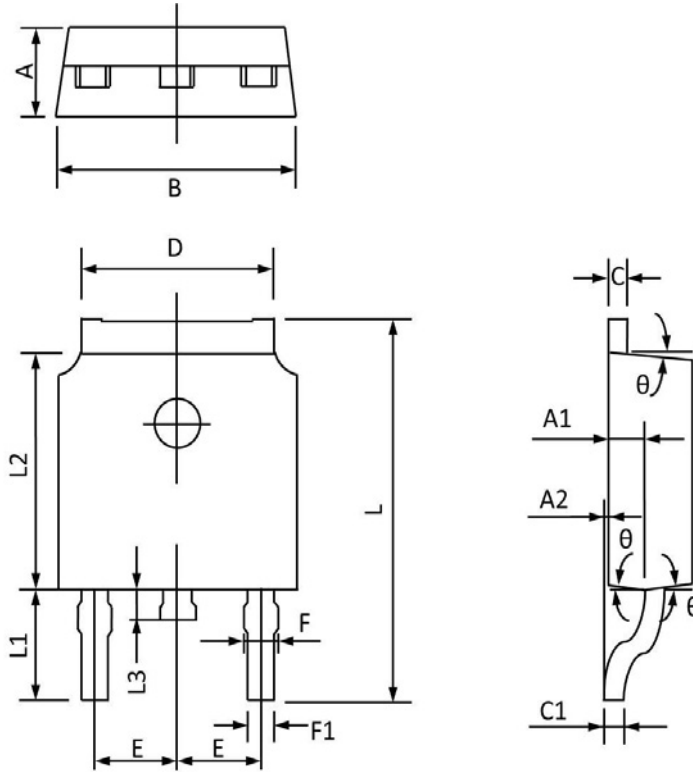


**Figure 7. Switching Time Waveform**



**Figure 8. EAS Waveform**

**Package Outline Dimensions (TO-252)**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MAX	MIN	MAX	MIN
A	2.400	2.200	0.094	0.087
A1	1.110	0.910	0.044	0.036
A2	0.150	0.000	0.006	0.000
B	6.800	6.400	0.268	0.252
C	0.580	0.450	0.023	0.018
C1	0.580	0.460	0.023	0.018
D	5.500	5.100	0.217	0.201
E	2.386	2.186	0.094	0.086
F	0.940	0.600	0.037	0.024
F1	0.860	0.500	0.034	0.020
L	10.400	9.400	0.409	0.370
L1	3.000	2.400	0.118	0.094
L2	6.200	5.400	0.244	0.213
L3	1.200	0.600	0.047	0.024
θ	9°	3°	9°	3°