GOOD-ARK
SEMICONDUCTOR

GSFD0646
60V N-Channel MOSFET

Main Product Characteristics

BV_{DSS}	60V
$R_{DS(ON)}$	12mΩ
I_D	45A
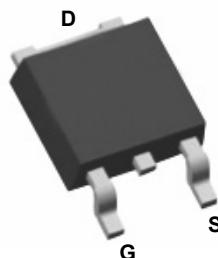
TO-252 (DPAK)
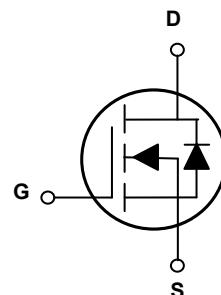
Schematic Diagram

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°C unless otherwise specified)

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

GSFD0646

60V N-Channel MOSFET

Electrical Characteristics (T$_J$=25°C unless otherwise specified)

| Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
On/Off Characteristics						
Drain-Source Breakdown Voltage	BV$_{DSS}$	V$_{GS}$=0V, I$_D$=250uA	60	-	-	V
BV$_{DSS}$ Temperature Coefficient	$\triangle$BV$_{DSS}$/$\triangle$T$_J$	Reference to 25°C, I$_D$=1mA	-	0.03	-	V/°C
Drain-Source Leakage Current	I$_{DSS}$	V$_{DS}$=60V, V$_{GS}$=0V, T$_J$=25°C	-	-	1	µA
		V$_{DS}$=48V, V$_{GS}$=0V, T$_J$=85°C	-	-	10	µA
Gate-Source Leakage Current	I$_{GSS}$	V$_{GS}$=±20V, V$_{DS}$=0V	-	-	±100	nA
Static Drain-Source On-Resistance[3]	R$_{DS(ON)}$	V$_{GS}$=10V, I$_D$=10A	-	10	12	mΩ
		V$_{GS}$=4.5V, I$_D$=8A	-	12	15	
Gate Threshold Voltage	V$_{GS(th)}$	V$_{GS}$=V$_{DS}$, I$_D$=250uA	1.2	1.6	2.5	V
V$_{GS(th)}$ Temperature Coefficient	$\triangle$V$_{GS(th)}$		-	-4	-	mV/°C
Forward Transconductance	g$_{fs}$	V$_{DS}$=10V, I$_D$=6A	-	11.7	-	S
Dynamic and Switching Characteristics						
Total Gate Charge[3,4]	Q$_g$	V$_{DS}$=30V, I$_D$=10A V$_{GS}$=10V	-	39.2	59	nC
Gate-Source Charge[3,4]	Q$_{gs}$		-	5.9	9	
Gate-Drain Charge[3,4]	Q$_{gd}$		-	8.8	14	
Turn-On Delay Time[3,4]	t$_{d(on)}$	V$_{DD}$=15V, R$_G$=6Ω, V$_{GS}$=10V, I$_D$=1A	-	9.6	18	nS
Rise Time[3,4]	t$_r$		-	28.2	54	
Turn-Off Delay Time[3,4]	t$_{d(off)}$		-	45.3	86	
Fall Time[3,4]	t$_f$		-	10.9	21	
Input Capacitance	C$_{Iss}$	V$_{DS}$=25V, V$_{GS}$=0V, F=1MHz	-	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=1MHz	-	1.6	3.2	Ω
Drain-Source Diode Characteristics and Maximum Ratings						
Continuous Source Current	I$_S$	V$_G$=V$_D$=0V, Force Current	-	-	45	A
Pulsed Source Current[3]	I$_{SM}$		-	-	180	A
Diode Forward Voltage[3]	V$_{SD}$	V$_{GS}$=0V, I$_S$=1A, T$_J$=25°C	-	-	1	V

Note:

1. Repetitive rating: Pulsed width limited by maximum junction temperature.

2. V$_{DD}$=25V, V$_{GS}$=10V, L=0.1mH, I$_{AS}$=35A, R$_G$=25Ω, starting T$_J$=25°C.

3. Pulse test: pulse width ≤300us, duty cycle≤2%.

4. Essentially independent of operating temperature.

# Typical Electrical and Thermal Characteristic Curves
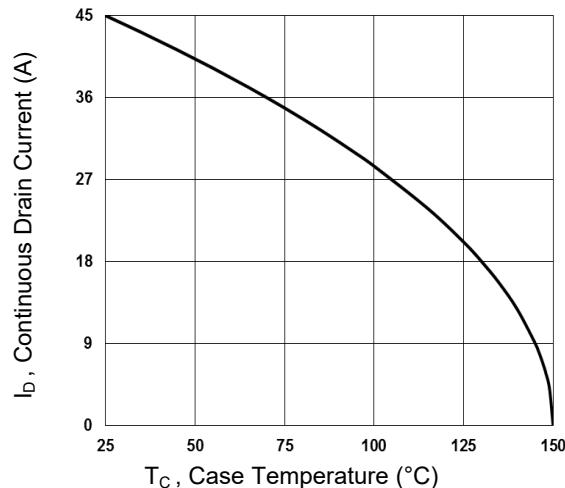

Figure 1. Continuous Drain Current vs. T_C
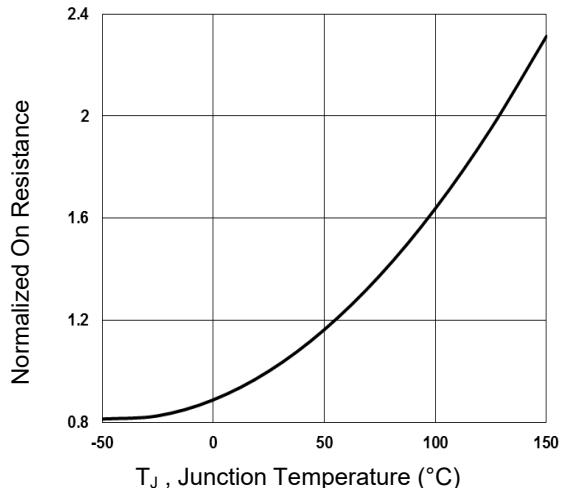
**Figure 2. Normalized R_{DSON} vs. T_J**
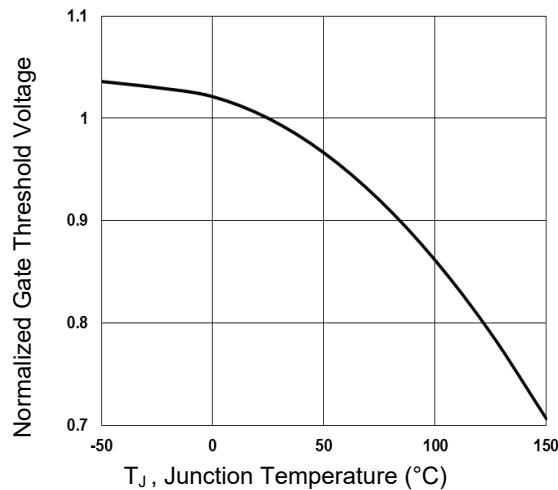
Figure 3. Normalized V_{th} vs. T_J
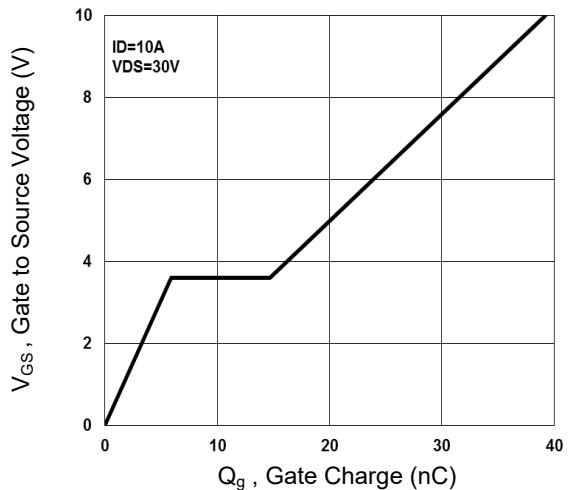

Figure 4. Gate Charge Waveform
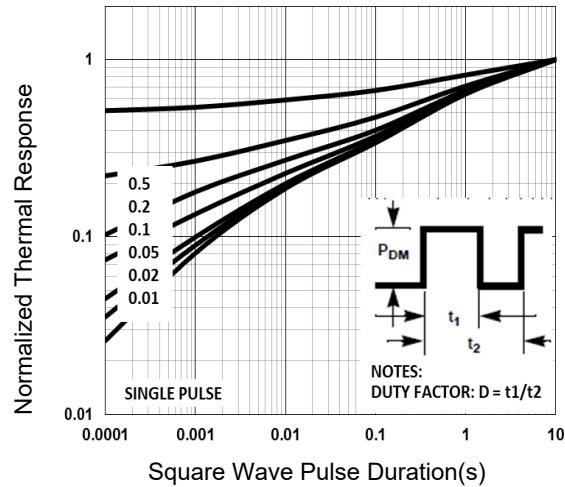
Figure 5. Normalized Transient Response
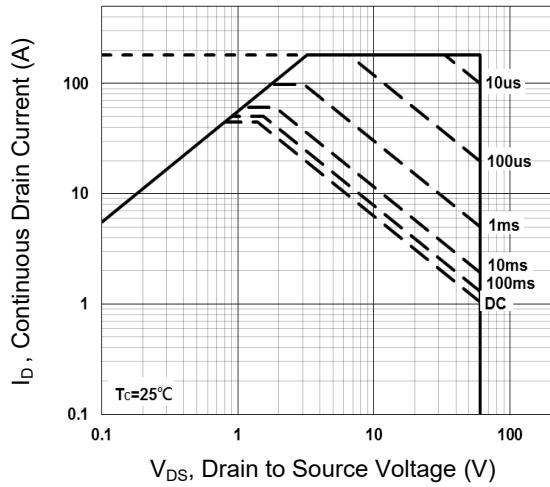

Figure 6. Maximum Safe Operation Area

Typical Electrical and Thermal Characteristic Curves
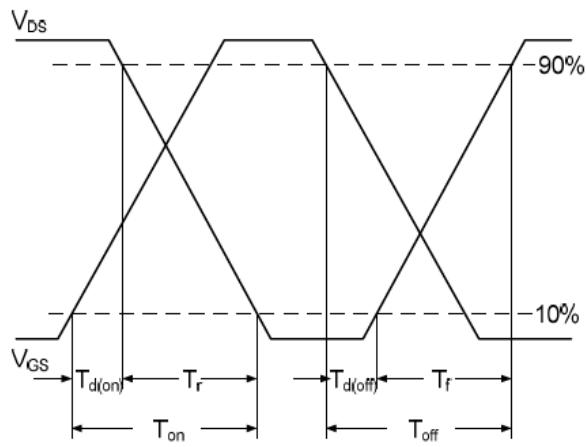
Firgure 7. Switching Time Waveform

$$EAS = \frac{1}{2} L \times I_{AS}^2 \times \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$
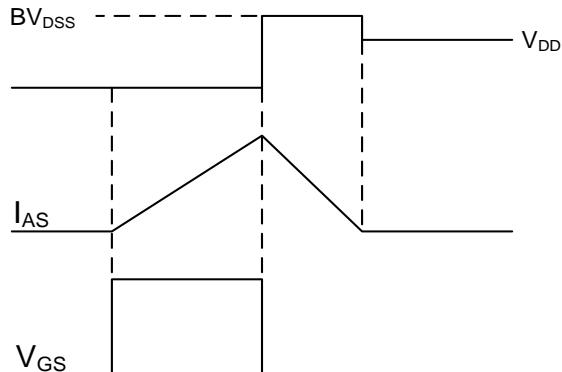
Firgure 8. EAS Waveform

Package Outline Dimensions (TO-252)
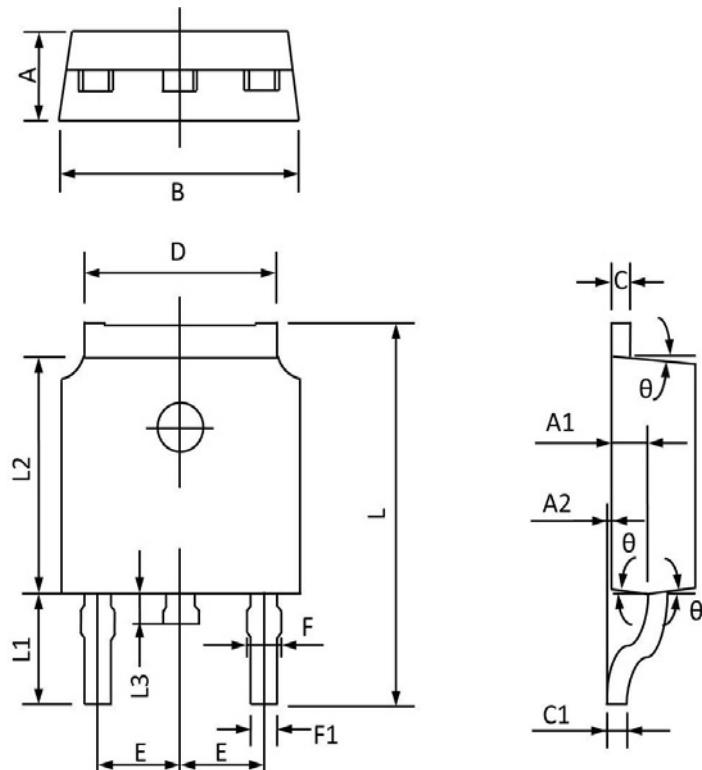
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MAX	MIN	MAX	MIN
A	2.400	2.200	0.094	0.087
A1	1.110	0.910	0.044	0.036
A2	0.150	0.000	0.006	0.000
B	6.800	6.400	0.268	0.252
C	0.580	0.450	0.023	0.018
C1	0.580	0.460	0.023	0.018
D	5.500	5.100	0.217	0.201
E	2.386	2.186	0.094	0.086
F	0.940	0.600	0.037	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°