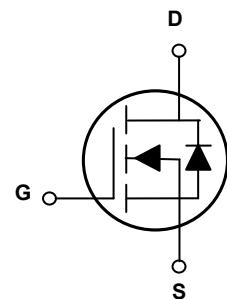
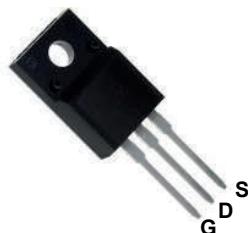


## Main Product Characteristics

$V_{(BR)DSS}$	650V
$R_{DS(ON)}$	0.79Ω (Max.)
$I_D$	13A



TO-220F

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 GSFU6513 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	$V_{DS}$	650	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V
Continuous Drain Current $T_C=25^\circ\text{C}$	$I_D$	13	A
		9	A
Pulsed Drain Current <sup>1</sup>	$I_{DM}$	50	A
Single Pulsed Avalanche Energy <sup>3</sup>	$E_{AS}$	786	mJ
Power Dissipation	$P_D$	51	W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.44	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	62.5	°C/W
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	°C

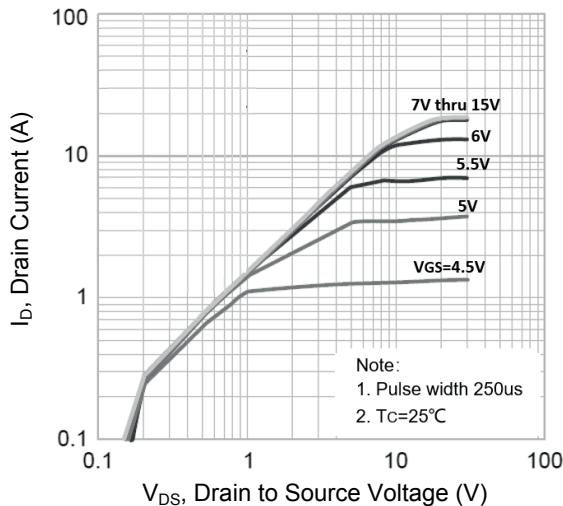
**Electrical Characteristics** ( $T_C=25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
<b>On / Off Characteristics</b>						
Drain-Source Breakdown Voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}}=0\text{V}, I_D=250\mu\text{A}$	650	-	-	V
Zero Gate Voltage Drain Current	$I_{\text{DSS}}$	$V_{\text{DS}}=650\text{V}, V_{\text{GS}}=0\text{V}, T_J=25^\circ\text{C}$	-	-	1	$\mu\text{A}$
		$V_{\text{DS}}=520\text{V}, V_{\text{GS}}=0\text{V}, T_J=125^\circ\text{C}$	-	-	50	
Gate to Body Leakage Current	$I_{\text{GSS}}$	$V_{\text{DS}}=0\text{V}, V_{\text{GS}}=\pm30\text{V}$	-	-	$\pm100$	nA
Gate Threshold Voltage	$V_{\text{GS}(\text{th})}$	$V_{\text{DS}}=V_{\text{GS}}, I_D=250\mu\text{A}$	2	-	4	V
Static Drain-Source on-Resistance <sup>2</sup>	$R_{\text{DS}(\text{ON})}$	$V_{\text{GS}}=10\text{V}, I_D=6.0\text{A}$	-	0.65	0.79	$\Omega$
<b>Dynamic and Switching Characteristics</b>						
Input Capacitance	$C_{\text{iss}}$	$V_{\text{DS}}=25\text{V}, V_{\text{GS}}=0\text{V}, F=1.0\text{MHz}$	-	1746	-	pF
Output Capacitance	$C_{\text{oss}}$		-	152	-	
Reverse Transfer Capacitance	$C_{\text{rss}}$		-	4.5	-	
Total Gate Charge	$Q_g$	$V_{\text{DD}}=520\text{V}, I_D=13\text{A}, V_{\text{GS}}=10\text{V}$	-	24.2	-	nC
Gate-Source Charge	$Q_{\text{gs}}$		-	7.9	-	
Gate-Drain ("Miller") Charge	$Q_{\text{gd}}$		-	7.5	-	
Turn-on Delay Time	$t_{\text{d}(\text{on})}$	$V_{\text{DD}}=325\text{V}, I_D=12\text{A}, R_G=25\Omega$	-	38	-	nS
Turn-on Rise Time	$t_r$		-	62	-	
Turn-off Delay Time	$t_{\text{d}(\text{off})}$		-	80.5	-	
Turn-off Fall Time	$t_f$		-	46.7	-	
<b>Source-Drain Ratings and Characteristics</b>						
Maximum Continuous Drain to Source Diode Forward Current	$I_s$		-	-	13	A
Maximum Pulsed Drain to Source Diode Forward Current	$I_{\text{SM}}$		-	-	50	A
Drain to Source Diode Forward Voltage	$V_{\text{SD}}$	$V_{\text{GS}}=0\text{V}, I_{\text{SD}}=12\text{A}$	-	-	1.4	V
Reverse Recovery Time	$T_{\text{rr}}$	$V_{\text{GS}}=0\text{V}, I_s=12\text{A}, \frac{di}{dt}=100\text{A}/\mu\text{s}$	-	590	-	ns
Reverse Recovery Charge	$Q_{\text{rr}}$		-	5.62	-	$\mu\text{C}$

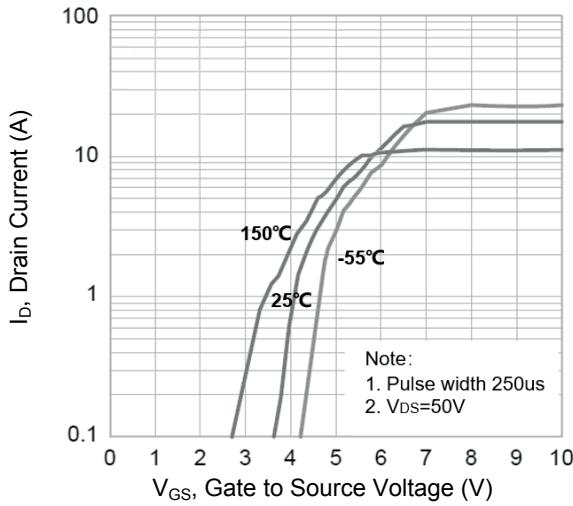
Notes

1. Pulse test: Pulse width  $\leq 300\text{us}$ , duty cycle  $\leq 2\%$ .
2. Repetitive rating; pulse width limited by max. junction temperature.
3.  $L=30\text{mH}, I_{AS}=6.6\text{A}, V_{DD}=140\text{V}, T_J=25^\circ\text{C}$ .

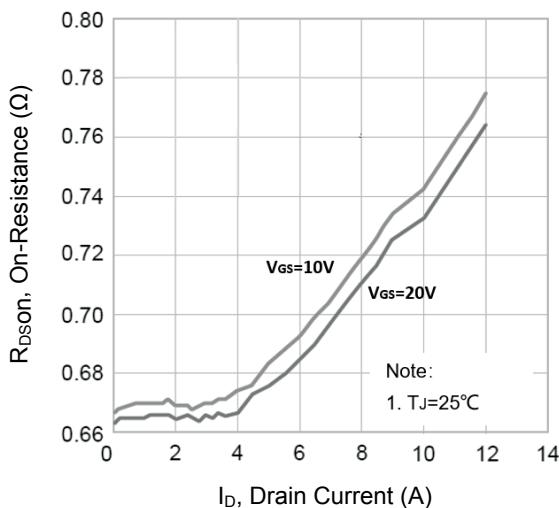
## Typical Electrical and Thermal Characteristic Curves



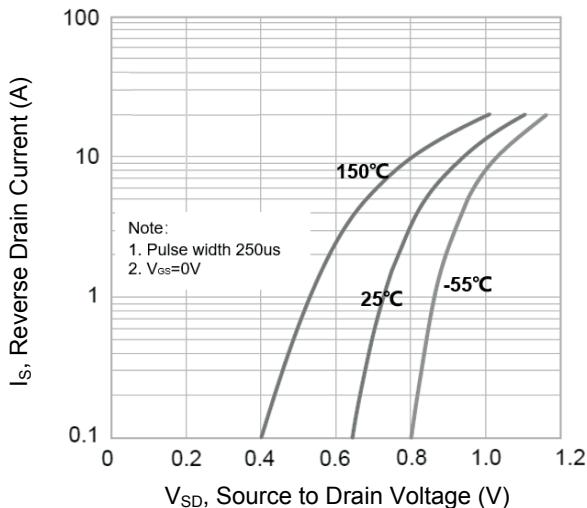
**Figure 1. Output Characteristics**



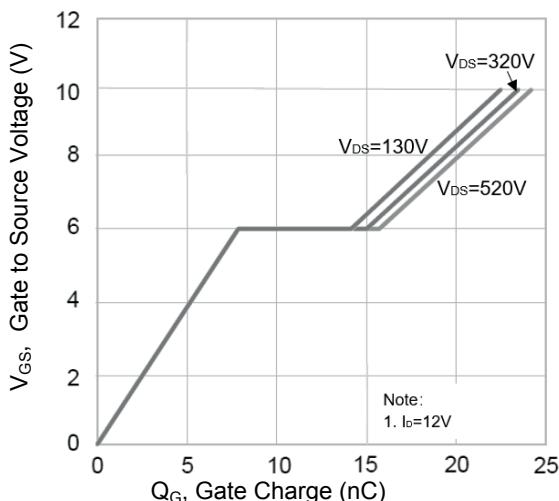
**Figure 2. Transfer Characteristics**



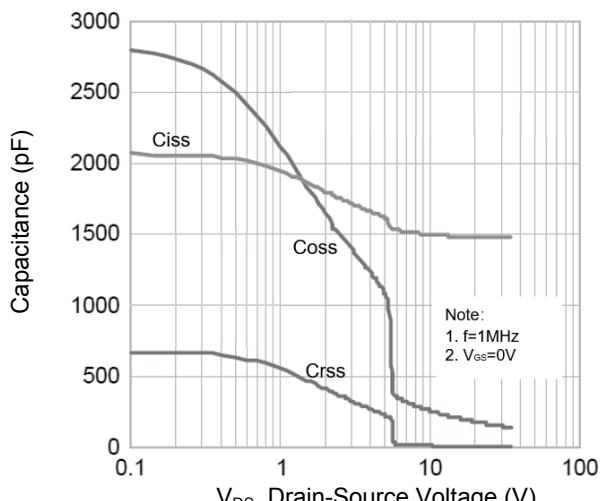
**Figure 3.  $R_{DS(on)}$  vs. Drain Current**



**Figure 4. Body Diode Characteristics**



**Figure 5. Gate Charge**



**Figure 6. Capacitance Characteristics**

## Typical Electrical and Thermal Characteristic Curves

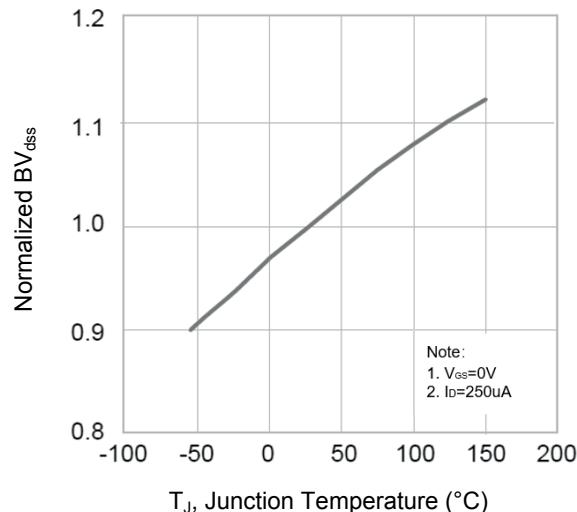


Figure 7. Normalized  $BV_{dss}$  vs. Junction Temperature

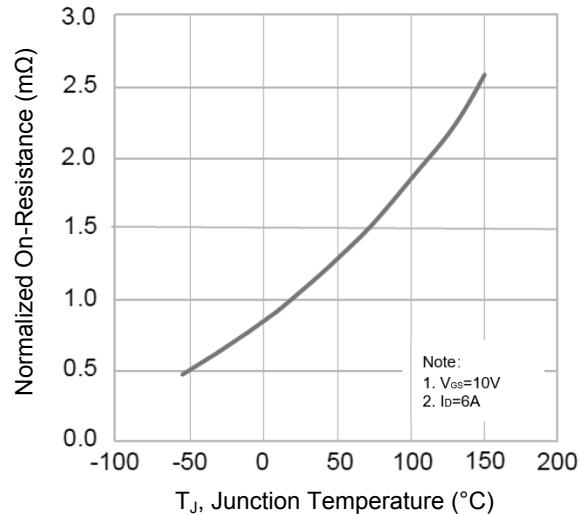


Figure 8. Normalized  $R_{DS(on)}$  vs. Junction Temperature

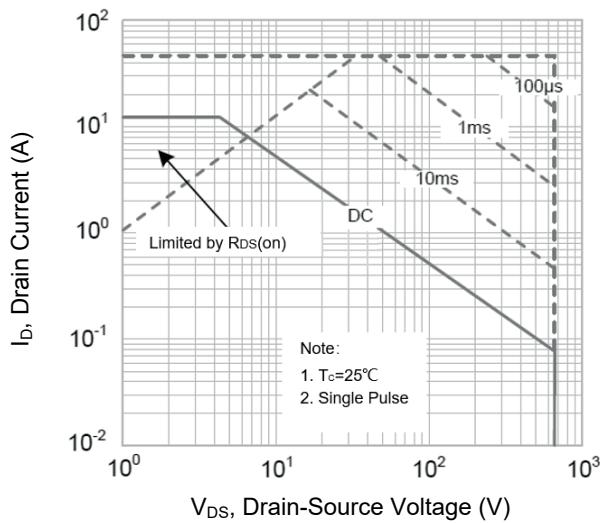
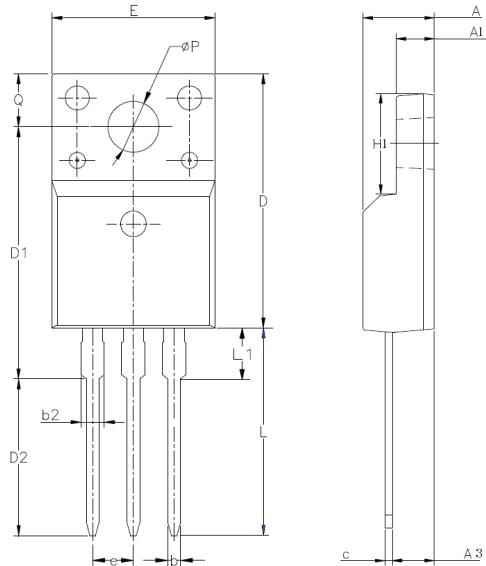


Figure 9. Safe Operation Area

## Package Outline Dimensions (TO-220F)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.42	5.02	0.174	0.198
A1	2.30	2.80	0.091	0.110
A3	2.50	3.10	0.098	0.122
b	0.55	0.85	0.020	0.033
b2	-	1.29	-	0.051
c	0.35	0.65	0.014	0.026
D	15.25	16.25	0.600	0.640
D1	13.97	14.97	0.550	0.589
D2	10.58	11.58	0.417	0.456
E	9.73	10.36	0.383	0.408
e	2.54 BCS		0.10 BCS	
H1	6.40	7.00	0.252	0.276
L	12.48	13.48	0.491	0.531
L1	-	2.00	-	0.079
ΦP	3.00	3.40	0.118	0.134
Q	3.05	3.55	0.120	0.140

## Order Information

Device	Package	Marking	Carrier	Quantity
GSFU6513	TO-220F	FU6513	Tube	50 pcs / Tube