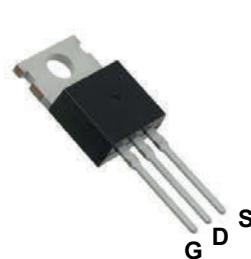
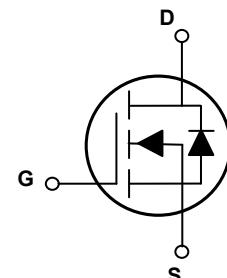


Main Product Characteristics

$V_{(BR)DSS}$	650V
$R_{DS(ON)}$	0.40Ω (max.)
I_D	11A



TO-220



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 GSFH65R400 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 ($T_A=25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Parameter.	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-to-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current, @ Steady-State ($T_C=25^\circ\text{C}$)	I_D	11	A
Continuous Drain Current, @ Steady-State ($T_C=100^\circ\text{C}$)		7	A
Pulsed Drain Current	I_{DM}	44	A
Power Dissipation ($T_C=25^\circ\text{C}$)	P_D	96	W
		0.77	W/ $^\circ\text{C}$
Single Pulse Avalanche Energy ¹	E_{AS}	356	mJ
Single Pulse Avalanche Current	I_{AS}	2.8	A
Body Diode Reverse Voltage Slope ²	dv/dt	15	V/ns
MOS dv/dt Reggedness ³	dv/dt	100	V/ns
Junction-to-Ambient (PCB Mounted, Steady-State)	$R_{\theta JA}$	62.0	$^\circ\text{C}/\text{W}$
Junction-to-Case	$R_{\theta JC}$	1.3	$^\circ\text{C}/\text{W}$
Operating Junction and Storage Temperature Range	T_J/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
On / Off Characteristics						
Drain-to-Source Breakdown Voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}}=0\text{V}, I_D=250\mu\text{A}$	650	-	-	V
Drain-to-Source Leakage Current	I_{DSS}	$V_{\text{DS}}=650\text{V}, V_{\text{GS}}=0\text{V}, T_J=25^\circ\text{C}$	-	-	1.0	μA
		$V_{\text{DS}}=650\text{V}, V_{\text{GS}}=0\text{V}, T_J=125^\circ\text{C}$	-	1.5	-	μA
Gate-to-Source Forward Leakage	I_{GSS}	$V_{\text{DS}}=0\text{V}, V_{\text{GS}}=30\text{V}$	-	-	100	nA
		$V_{\text{DS}}=0\text{V}, V_{\text{GS}}=-30\text{V}$	-	-	-100	
Static Drain-to-Source On-Resistance	$R_{\text{DS}(\text{ON})}$	$V_{\text{GS}}=10\text{V}, I_D=5.5\text{A}$	-	0.33	0.40	Ω
Gate Threshold Voltage	$V_{\text{GS}(\text{th})}$	$V_{\text{DS}}=V_{\text{GS}}, I_D=250\mu\text{A}$	2.0	-	4.0	V
Dynamic and Switching Characteristics						
Input Capacitance	C_{iss}	$V_{\text{GS}}=0\text{V}, V_{\text{DS}}=100\text{V}, F=1\text{MHz}$	-	925	-	pF
Output Capacitance	C_{oss}		-	30	-	
Reverse Transfer Capacitance	C_{rss}		-	0.8	-	
Total Gate Charge ^{4,5}	Q_g	$I_D=11\text{A}, V_{\text{DD}}=520\text{V}, V_{\text{GS}}=10\text{V}$	-	30	-	nC
Gate-to-Source Charge ^{4,5}	Q_{gs}		-	7.8	-	
Gate-to-Drain ("Miller") Charge ^{4,5}	Q_{gd}		-	15	-	
Gate Plateau ^{4,5}	V_{plateau}		-	6.9	-	V
Turn-on Delay Time ^{4,5}	$t_{\text{d}(\text{on})}$	$V_{\text{DD}}=325\text{V}, V_{\text{GS}}=10\text{V}, R_G=24\Omega, I_D=11\text{A}$	-	15	-	nS
Rise Time ^{4,5}	t_r		-	35	-	
Turn-Off Delay Time ^{4,5}	$t_{\text{d}(\text{off})}$		-	65	-	
Fall Time ^{4,5}	t_f		-	30	-	
Gate Resistance	R_g	$F=1\text{MHz}$	-	3.6	-	Ω
Source-Drain Ratings and Characteristics						
Continuous Source Current (Body Diode)	I_S	$T_C=25^\circ\text{C}$, MOSFET symbol showing the integral reverse p-n junction diode.	-	-	11	A
Diode Pulse Current	$I_{\text{S, pulse}}$		-	-	44	A
Diode Forward Voltage	V_{SD}	$I_S=11\text{A}, V_{\text{GS}}=0\text{V}$	-	-	1.4	V
Reverse Recovery Time ⁴	T_{rr}	$I_S=11\text{A}, V_{\text{GS}}=0\text{V}, dI/dt=100\text{A/us}$	-	254	-	nS
Reverse Recovery Charge ⁴	Q_{rr}		-	3.2	-	μC
Reverse Recovery Peak Current ⁴	I_{rrm}		-	25	-	A

Note:

1. $L=79\text{mH}, V_{\text{DD}}=100\text{V}, R_G=25\Omega$, starting temperature $T_J=25^\circ\text{C}$.
2. $V_{\text{DS}}=0-400\text{V}, I_{\text{SD}} \leq I_S, T_J=25^\circ\text{C}$.
3. $V_{\text{DS}}=0-480\text{V}$.
4. Pulse test : pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
5. Essentially independent of operating temperature.

Typical Electrical and Thermal Characteristic Curves

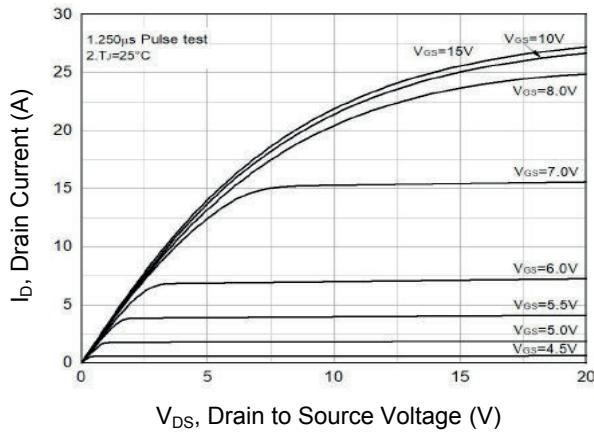


Figure 1. Typical Output Characteristics

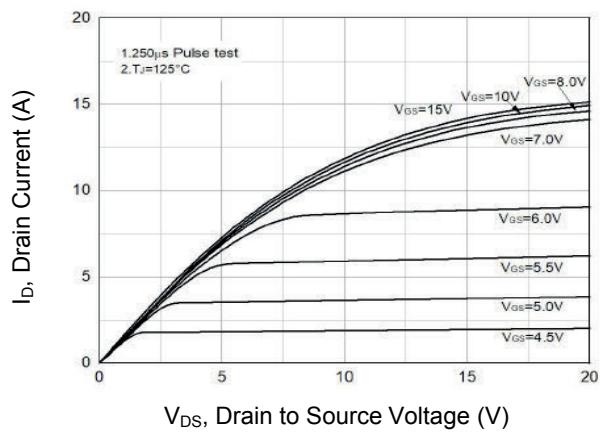


Figure 2. Typical Output Characteristics

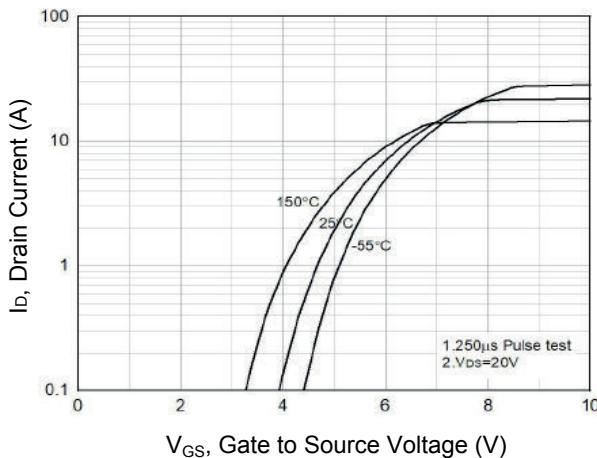


Figure 3. Transfer Characteristics

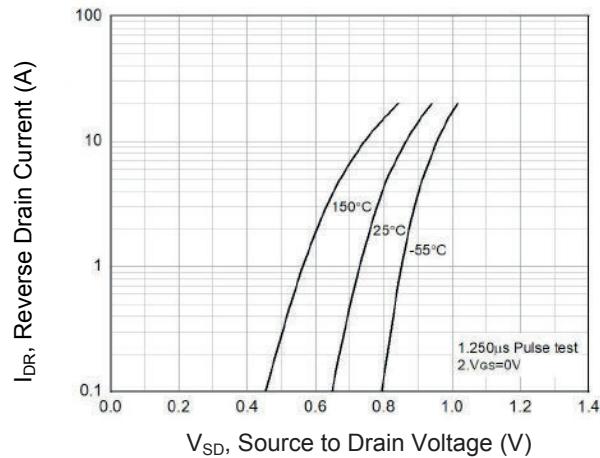


Figure 4. Body Diode Characteristics

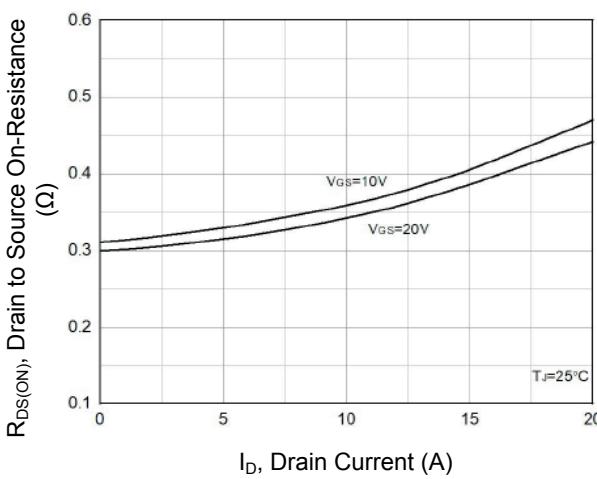


Figure 5. On-Resistance vs. Drain Current

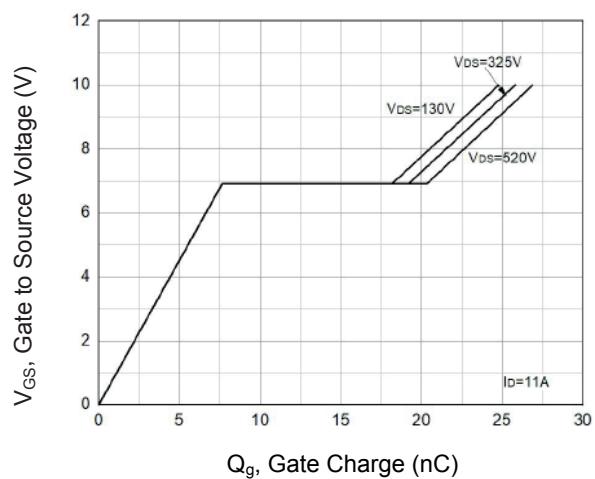


Figure 6. Gate Charge Characteristic

Typical Electrical and Thermal Characteristic Curves

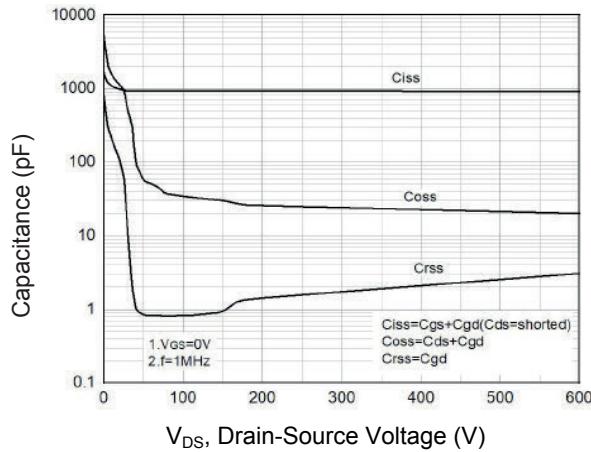


Figure 7. Capacitance Characteristics

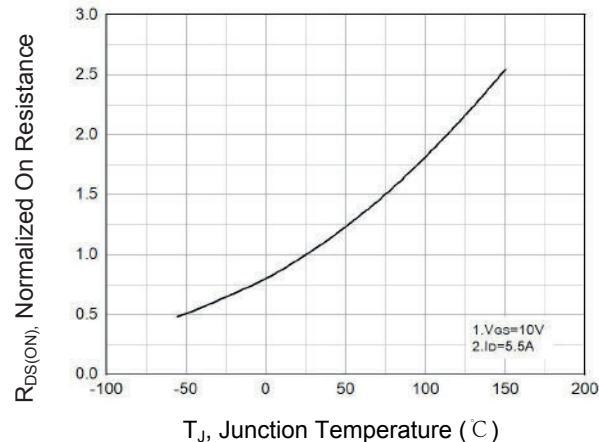


Figure 8. Normalized On-Resistance vs. T_J

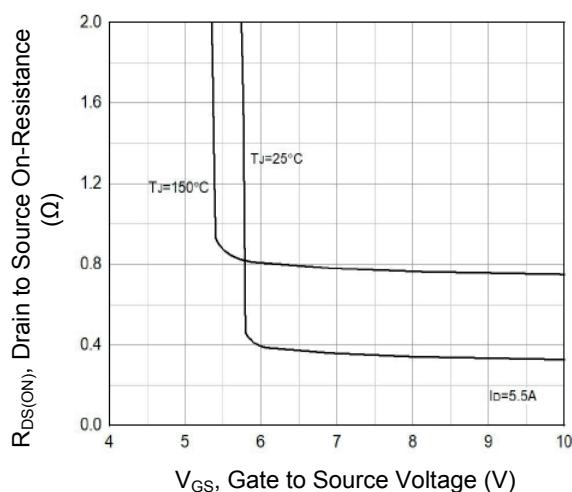


Figure 9. Normalized R_{DSON} Vs. V_{GS}

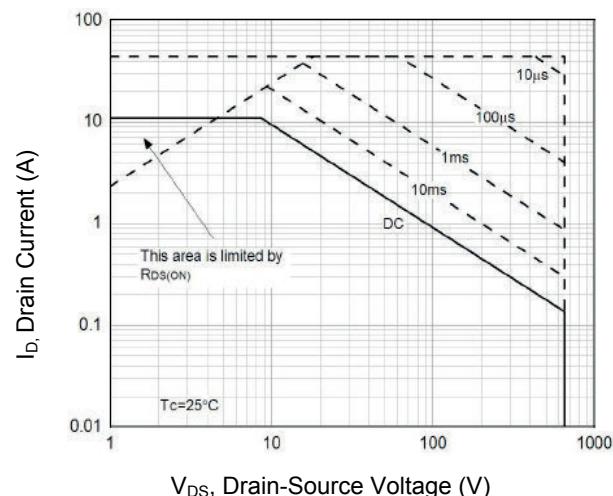


Figure 10. Safe Operation Area

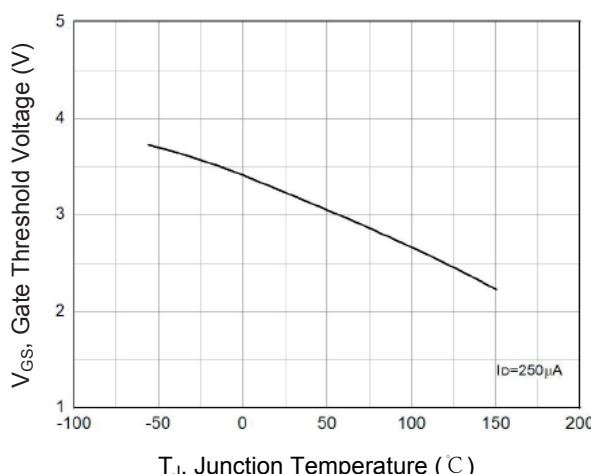


Figure 11. Gate Threshold Voltage vs. T_J

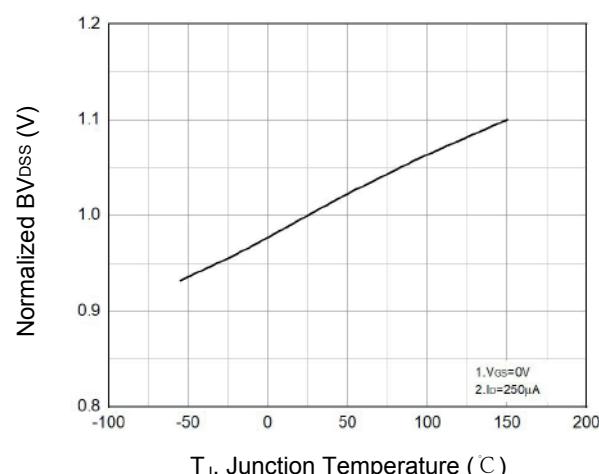


Figure 12. Normalized BV_{DSS} Vs. T_J

Typical Electrical and Thermal Characteristic Curves

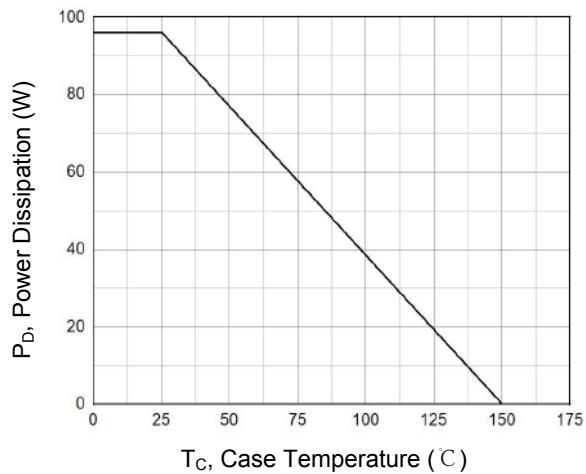
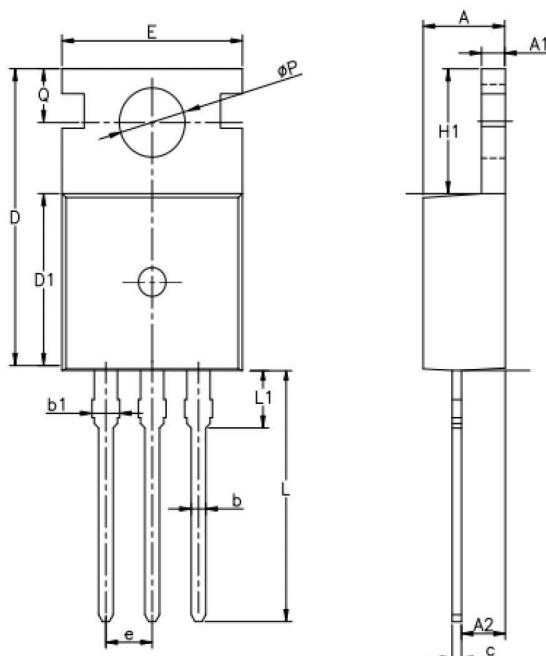


Figure 13. Power Dissipation vs. T_C

Package Outline Dimensions (TO-220)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.300	4.700	0.169	0.185
A1	1.000	1.500	0.039	0.059
A2	1.800	2.800	0.071	0.110
b	0.600	1.000	0.024	0.039
b1	1.000	1.600	0.039	0.063
c	0.300	0.700	0.012	0.028
D	15.100	16.100	0.594	0.634
D1	8.100	10.000	0.319	0.394
E	9.600	10.400	0.378	0.409
e	2.540 BSC		0.100 BSC	
H1	6.100	7.000	0.240	0.276
L	12.600	13.600	0.496	0.535
L1	-	3.950	-	0.156
ΦP	3.400	3.900	0.134	0.154
Q	2.600	3.200	0.102	0.126