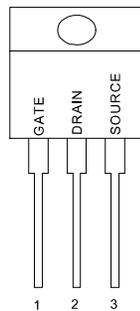


### GENERAL DESCRIPTION

This high voltage MOSFET uses an advanced termination scheme to provide enhanced voltage-blocking capability without degrading performance over time. In addition, this advanced MOSFET is designed to withstand high energy in avalanche and commutation modes. The new energy efficient design also offers a drain-to-source diode with a fast recovery time. Designed for high voltage, high speed switching applications in power supplies, converters and PWM motor controls, these devices are particularly well suited for bridge circuits where diode speed and commutating safe operating areas are critical and offer additional and safety margin against unexpected voltage transients.

### PIN CONFIGURATION

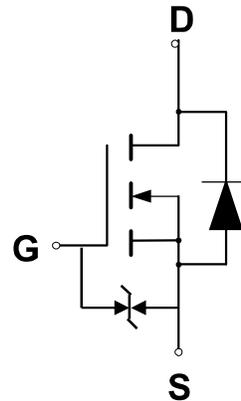
TO220/TO-220F  
Top View



### FEATURES

- ◆ Robust High Voltage Termination
- ◆ Avalanche Energy Specified
- ◆ Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- ◆ Diode is Characterized for Use in Bridge Circuits
- ◆  $I_{DSS}$  and  $V_{DS(on)}$  Specified at Elevated Temperature
- ◆ Ciss improvement

### SYMBOL



N-Channel MOSFET

### ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain to Current — Continuous	$I_D$	13	A
— Pulsed	$I_{DM}$	39	
Gate-to-Source Voltage — Continue	$V_{GS}$	$\pm 30$	V
Total Power Dissipation — TO220	$P_D$	193	W
— TO220FP		47	
Derate above 25°C — TO220		1.54	W/°C
— TO220FP		0.38	
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	°C
Single Pulse Drain-to-Source Avalanche Energy — $T_J = 25^\circ\text{C}$ ( $V_{DD} = 100\text{V}, V_{GS} = 10\text{V}, I_L = 11\text{A}, L = 10\text{mH}, R_G = 25\Omega$ )	$E_{AS}$	605	mJ
Thermal Resistance — Junction to Case -TO220	$\theta_{JC}$	0.64	°C/W
— Junction to Case -TO220FP		3.7	
— Junction to Ambient -TO220, TO220FP	$\theta_{JA}$	62.5	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$	260	°C
ESD SENSITIVITY — HBM, C=100pF, R=1.5kΩ	$V_{esd}$	2000	V

### ORDERING INFORMATION

Part Number	Package
GPT13N50GN220*	TO-220
GPT13N50DGN220FP*	TO-220F

\*Note: G : Suffix for PB Free Product

### ELECTRICAL CHARACTERISTICS

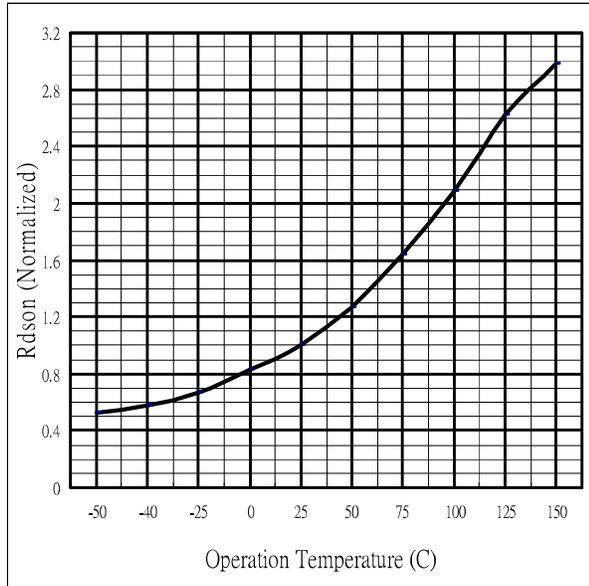
Unless otherwise specified,  $T_J = 25^\circ\text{C}$ .

Characteristic	Symbol	GPT13N50			Units
		Min	Typ	Max	
Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{ V}$ , $I_D = 250\ \mu\text{A}$ )	$V_{(BR)DSS}$	500			V
Drain-Source Leakage Current ( $V_{DS} = 500\text{ V}$ , $V_{GS} = 0\text{ V}$ )	$I_{DSS}$			1	$\mu\text{A}$
Gate-Source Leakage Current-Forward ( $V_{gsf} = 30\text{ V}$ , $V_{DS} = 0\text{ V}$ )	$I_{GSSF}$			100	nA
Gate-Source Leakage Current-Reverse ( $V_{gsr} = -30\text{ V}$ , $V_{DS} = 0\text{ V}$ )	$I_{GSSR}$			100	nA
Gate Threshold Voltage ( $V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$ )	$V_{GS(th)}$	3		5	V
Static Drain-Source On-Resistance ( $V_{GS} = 10\text{ V}$ , $I_D = 6.5\text{A}$ ) *	$R_{DS(on)}$			0.49	$\Omega$
Forward Transconductance ( $V_{DS} = 15\text{ V}$ , $I_D = 6.5\text{A}$ ) *	$g_{FS}$		8.7		S
Input Capacitance	$(V_{DS} = 25\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{iss}$	1578		pF
Output Capacitance		$C_{oss}$	180		pF
Reverse Transfer Capacitance		$C_{rss}$	9.8		pF
Turn-On Delay Time		$t_{d(on)}$	33		ns
Rise Time	$(V_{DD} = 250\text{ V}$ , $I_D = 13\text{ A}$ , $R_G = 25\Omega$ ) *	$t_r$	59		ns
Turn-Off Delay Time		$t_{d(off)}$	75		ns
Fall Time		$t_f$	34.8		ns
Total Gate Charge		$Q_g$	31		nC
Gate-Source Charge	$(V_{DS} = 400\text{ V}$ , $I_D = 13\text{ A}$ , $V_{GS} = 10\text{ V}$ )*	$Q_{gs}$	8.7		nC
Gate-Drain Charge		$Q_{gd}$	12		nC
<b>SOURCE-DRAIN DIODE CHARACTERISTICS</b>					
Forward On-Voltage(1)	$(I_S = 13\text{ A}$ , $V_{GS} = 0\text{ V}$ , $d_i/d_t = 100\text{A}/\mu\text{s}$ )	$V_{SD}$		1.5	V
Forward Turn-On Time		$t_{on}$		**	ns
Reverse Recovery Time		$t_{rr}$		450	ns

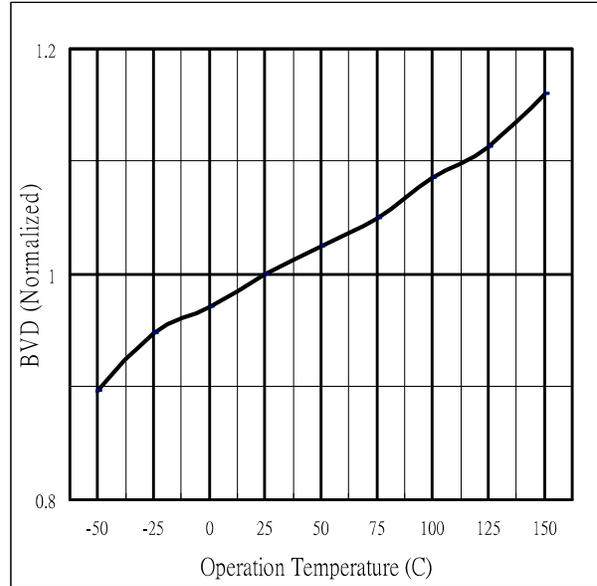
\* Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$

\*\* Negligible, Dominated by circuit inductance

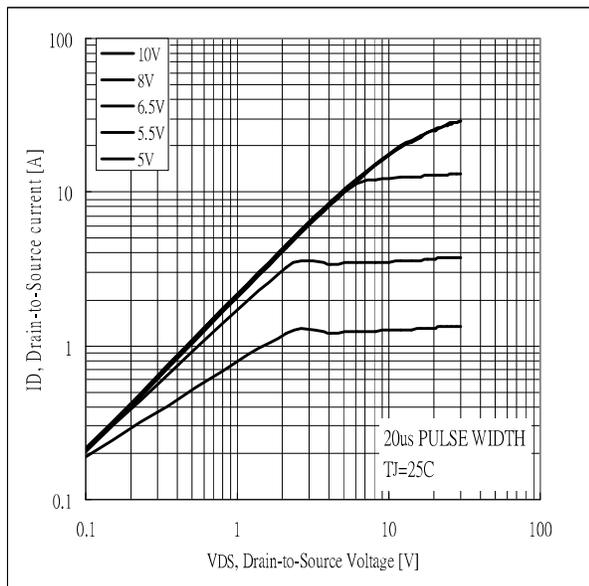
**TYPICAL ELECTRICAL CHARACTERISTICS**



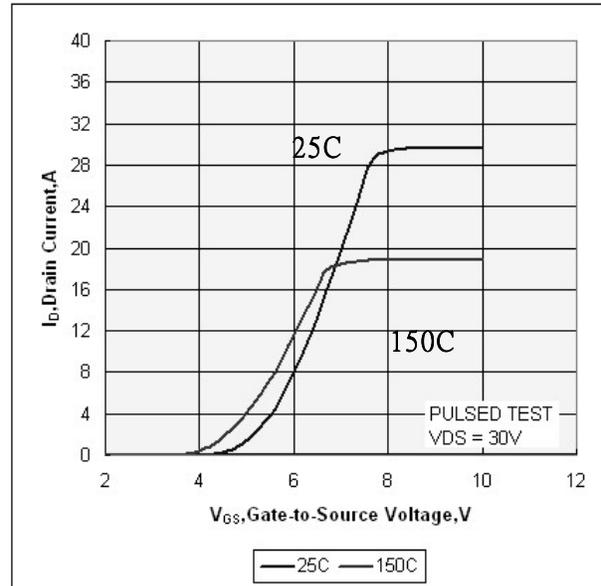
**Fig 1. On-Resistance Variation with vs. Temperature**



**Fig.2 Breakdown Voltage Variation vs. Temperature**



**Fig 3. Typical Output Characteristics**



**Fig 5. Typical Transfer Characteristics**

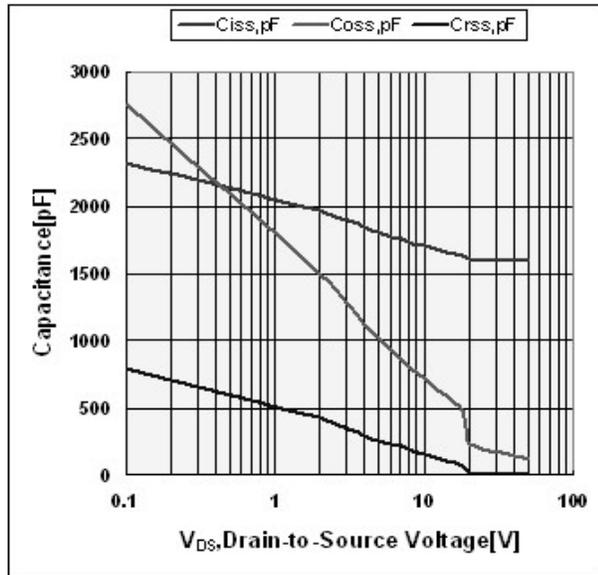


Fig 6. Typical Capacitance Vs. Gate-to-Source Voltage

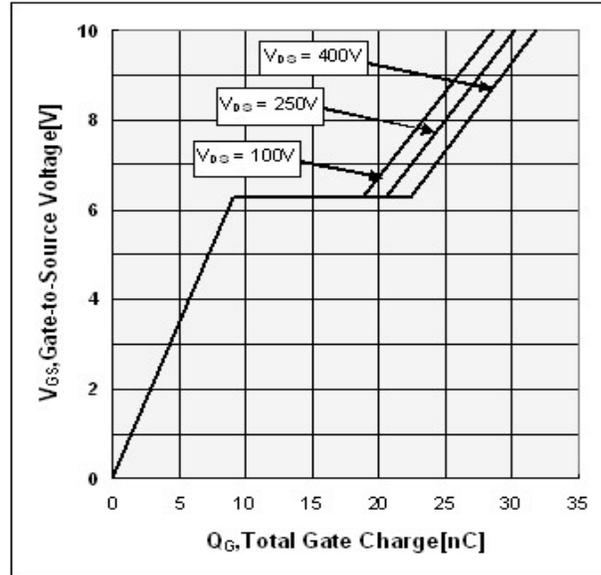
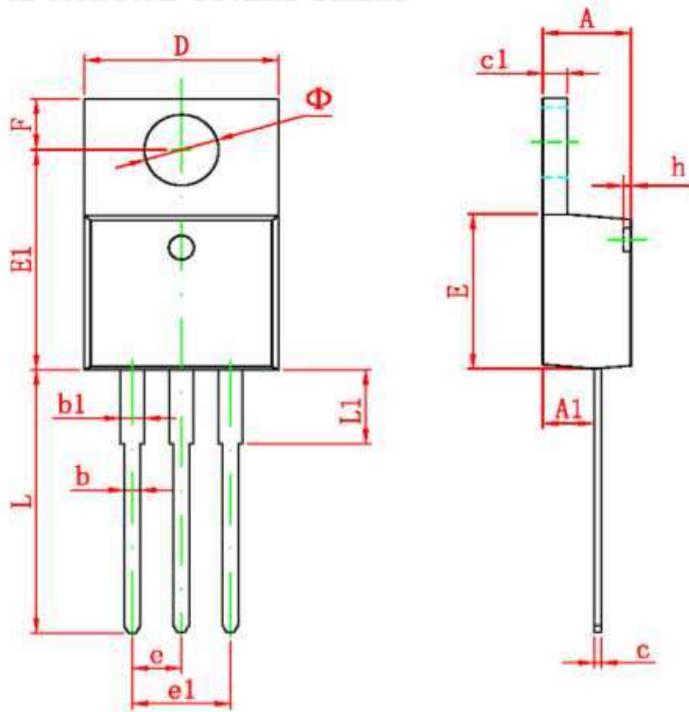


Fig 6. Typical Gate Charge Vs. Drain-to-Source Voltage

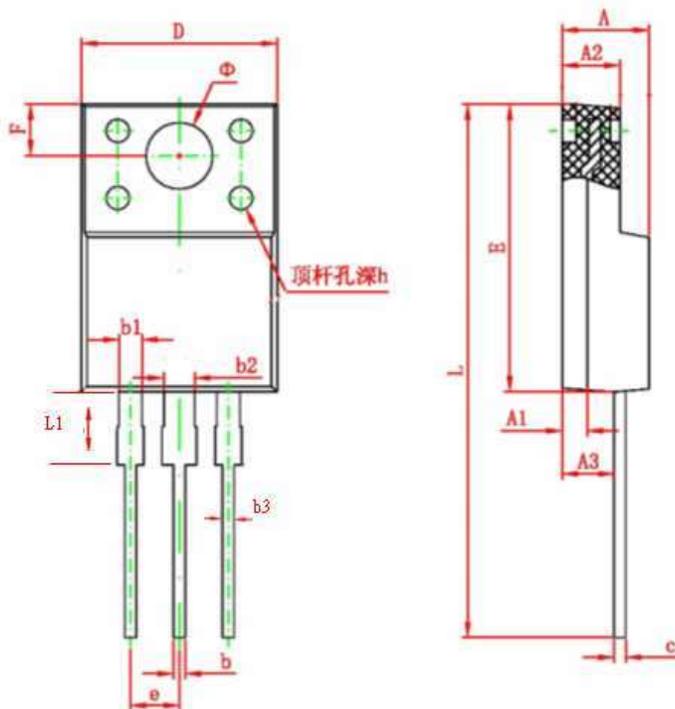
**PACKAGE DIMENSION**

**TO-220**



Symbol	Dimensions In Millimeters	
	Min.	Max
A	4.40	4.80
A1	2.10	2.84
b	0.71	0.91
b1	1.17	1.37
c	0.30	0.60
c1	1.17	1.47
D	9.40	10.60
E	8.40	9.60
e	2.54 TYP.	
el	4.90	5.60
F	3.00 REF.	
$\Phi$	3.50 REF.	
h	0.00	0.30
L	12.50	14.00
L1	3.50	4.00

**TO-220F**



Symbol	Dimensions In Millimeters	
	Min.	Max
A	3.80	4.70
A1	1.3 REF.	
A2	2.20	3.20
A3	2.10	3.20
b	0.30	0.95
b1	1.00	1.75
b2	1.00	1.75
b3	0.50	0.80
c	0.30	0.90
D	9.90	10.40
E	14.60	16.20
e	2.54 TYP.	
F	3.00 REF.	
$\Phi$	3.50 REF.	
h	0.00	0.30
L	28.00	30.00
L1	3.20	3.55

## IMPORTANT NOTICE

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