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S

650V N-Channel MOSFET

General Features

- \triangleright Proprietary New Planar Technology
- $R_{\text{DS(ON),typ.}} = 0.36 \ \Omega @V_{\text{GS}} = 10V$ \triangleright
- Low Gate Charge Minimize Switching Loss \triangleright
- Fast Recovery Body Diode

Applications

- Adaptor
- TV Main Power \triangleright
- SMPS Power Supply \triangleright
- LCD Panel Power \triangleright

Ordering Information

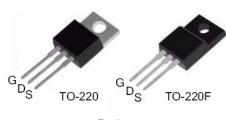
Part Number	Package	Brand
PTP20N65	TO-220	ï
PTA20N65	TO-220F	ï

Absolute Maximum Ratings

(Pb)	Lead	Free	Package	and	Finish
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BV _{DSS}	R _{DS(ON),typ.}	I _D
650V	0.36Ω	20A









Symbol	Parameter	PTP20N65	PTA20N65	Unit
V _{DSS}	Drain-to-Source Voltage ^[1]	65	50	V
V _{GSS}	Gate-to-Source Voltage	±3	30	v
I _D	Continuous Drain Current	2	0	
I _{D @ Tc =100} ℃	Continuous Drain Current @ Tc=100°C	Figure 3		А
I _{DM}	Pulsed Drain Current at V _{GS} =10V ^[2]	Figure 6		
E _{AS}	Single Pulse Avalanche Energy	550		mJ
dv/dt	Peak Diode Recovery dv/dt ^[3]	5.0		V/ns
D	Power Dissipation	160	65	W
P _D	Derating Factor above 25℃	1.28	0.52	W/°C
T _L T _{PAK}	Maximum Temperature for Soldering Leads at 0.063in (1.6mm) from Case for 10 seconds, Package Body for 10 seconds	300 260		°C
T _J & T _{STG}	Operating and Storage Temperature Range	-55 to	o 150	

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

Thermal Characteristics

Symbol	Parameter	PTP20N65	PTA20N65	Unit
$R_{ extsf{ heta}JC}$	Thermal Resistance, Junction-to-Case	0.78	1.92	
R _{θJA}	Thermal Resistance, Junction-to-Ambient	62	100	°CAW

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Electrical Characteristics

OFF Characteristics $T_J = 25^{\circ}C$ unless otherwise specified

Symbol	Parameter	Min.	Тур.	Max.	Unit	Test Conditions
BV _{DSS}	Drain-to-Source Breakdown Voltage	650			V	V _{GS} =0V, I _D =250uA
	Desire to Oscarso Las la se Oscarso t			1		V _{DS} =650V, V _{GS} =0V
IDSS	Drain-to-Source Leakage Current			100	uA	V _{DS} =520V, V _{GS} =0V, T _J =125℃
	Cata ta Sauraa Laakaga Currant			+100	m (V _{GS} =+30V, V _{DS} =0V
I _{GSS}	Gate-to-Source Leakage Current			-100	nA	V _{GS} =-30V, V _{DS} =0V

ON Characteristics

ON Chara	N Characteristics				$T_J = 25^{\circ}C$ unless otherwise specified			
Symbol	Parameter	Min.	Тур.	Max.	Unit	Test Conditions		
R _{DS(ON)}	Static Drain-to-Source On-Resistance ^[4]		0.36	0.50	Ω	V _{GS} =10V, I _D =10A		
$V_{GS(TH)}$	Gate Threshold Voltage	2.0		4.0	V	$V_{DS}=V_{GS}, I_{D}=250uA$		
gfs	Forward Transconductance ^[4]		15		S	VDS=15V,ID=10A		

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Тур.	Max.	Unit	Test Conditions
C _{iss}	Input Capacitance		2400			<u> </u>
C _{rss}	Reverse Transfer Capacitance		105		pF	V _{GS} =0V, V _{DS} =25V, f=1.0MH _Z
C _{oss}	Output Capacitance		225			
Qg	Total Gate Charge		65			
Q _{gs}	Gate-to-Source Charge		11		nC	V_{DD} =325V, I_{D} =20A, V_{GS} =0 to 10V
Q _{gd}	Gate-to-Drain (Miller) Charge		26			

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Тур.	Max.	Unit	Test Conditions
td(ON)	Turn-on Delay Time		35			
trise	Rise Time		82		~ 6	V _{DD} =325V, I _D =20A,
td(OFF)	Turn-Off Delay Time		180		nS	V _{GS} = 10V Rg=25 Ω
tfall	Fall Time		90			

Source-Drain Body Diode Characteristics

 $T_J=25^{\circ}C$ unless otherwise specified

Symbol	Parameter	Min	Тур.	Max.	Unit	Test Conditions
I _{SD}	Continuous Source Current ^[4]			20	۸	Integral PN-diode in
I _{SM}	Pulsed Source Current ^[4]			80	A	MOSFET
V _{SD}	Diode Forward Voltage			1.5	V	I _S =20A, V _{GS} =0V
trr	Reverse recovery time		390		ns	V _{GS} =0V ,I⊧=20A,
Qrr	Reverse recovery charge		3.4		uC	di⊧/dt=100A/µs

Note:

[1] T_J=+25℃ to +150℃

[2] Repetitive rating; pulse width limited by maximum junction temperature.

[3] ISD= 20A di/dt < 100 A/µs, VDD < BVDSS, TJ=+150 °C.

[4] Pulse width≤380µs; duty cycle≤2%.



Typical Characteristics

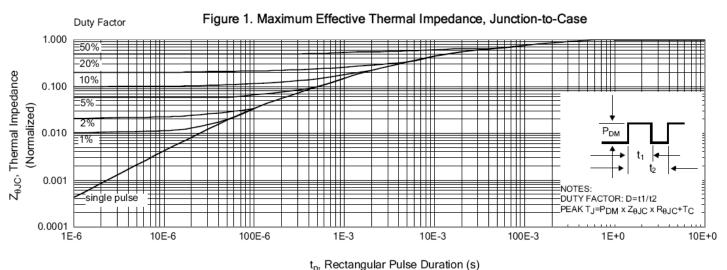
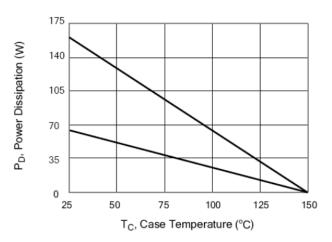


Figure 2. Maximum Power Dissipation vs Case Temperature



20

15

10

5

0

0

I_D, Drain Current (A)

PULSE DURATION = 250 µS DUTY FACTOR = 0.5%

MAX, T_C = 25 °C

3

6

9

V_{DS}, Drain-to-Source Voltage (V)

12

Figure 4. Typical Output Characteristics

Figure 3. Maximum Continuous Drain Current vs Case Temperature

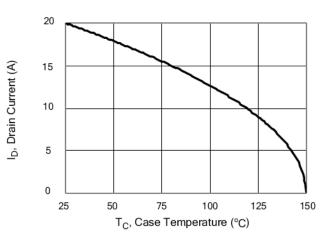
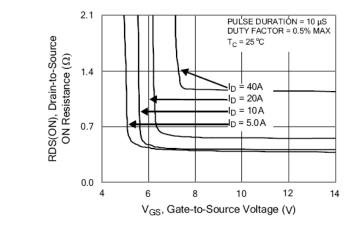


Figure 5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current



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GS = 15V

GS = 7.0V

GS = 6.5V

GS = 6.0V

VGS = 5.5V

18

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Typical Characteristics(Cont.)

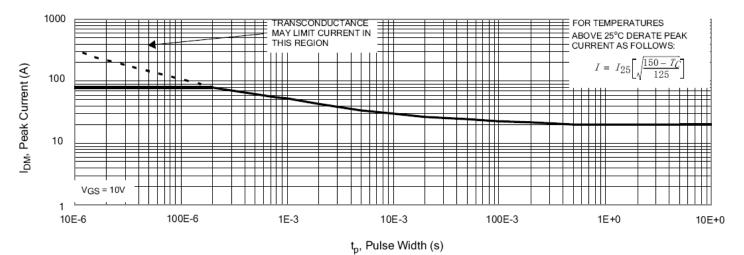
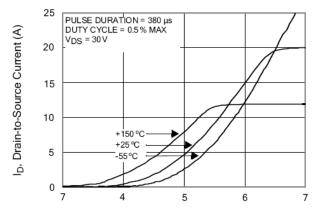


Figure 6. Maximum Peak Current Capability





V_{GS}, Gate-to-Source Voltage (V)

Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current

Figure 8. Unclamped Inductive Switching Capability

PTP20N65 PTA20N65

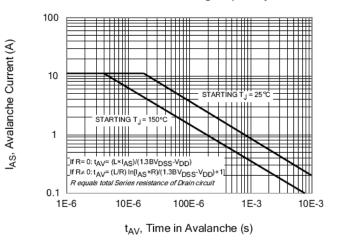
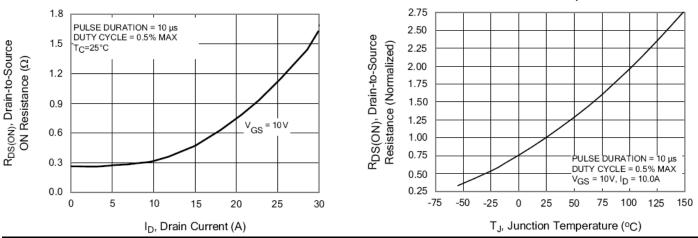


Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature

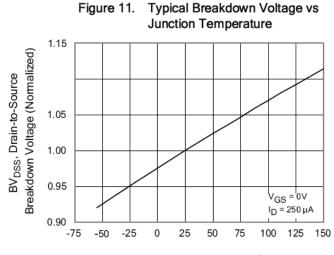


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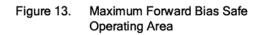
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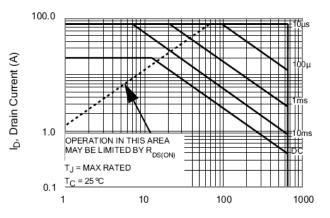
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Typical Characteristics(Cont.)

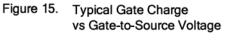


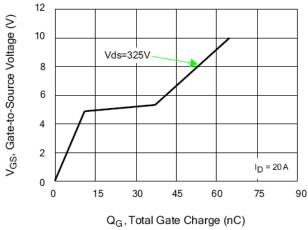
T_J, Junction Temperature (°C)

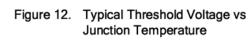


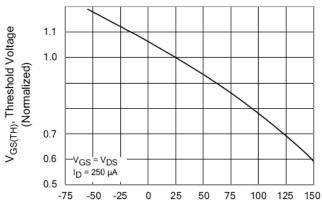


V_{DS}, Drain-to-Source Voltage (V)



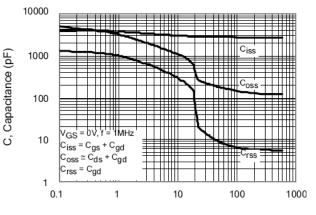






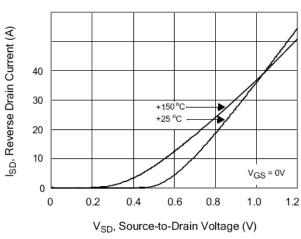
T_J, Junction Temperature (°C)

Figure 14. Typical Capacitance vs Drain-to-Source Voltage



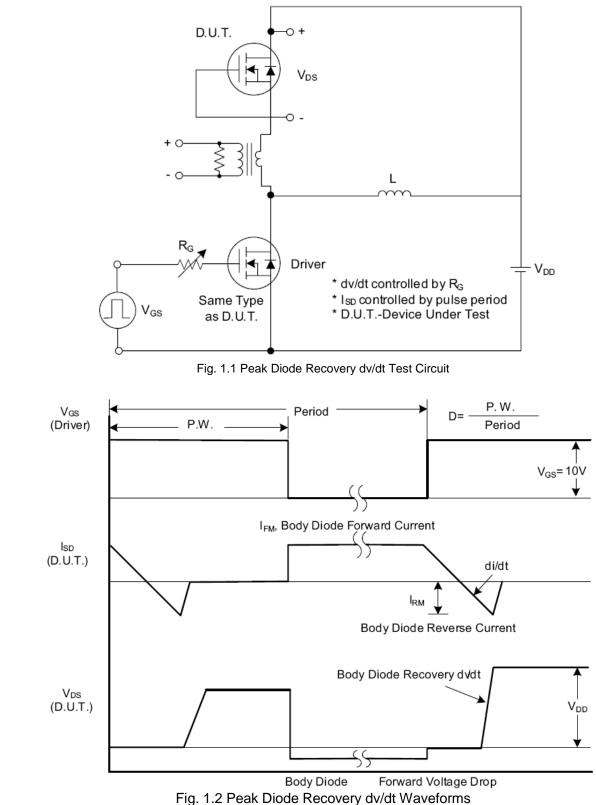
V_{DS}, Drain Voltage (V)

Figure 16. Typical Body Diode Transfer Characteristics



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Test Circuits and Waveforms (Cont.)

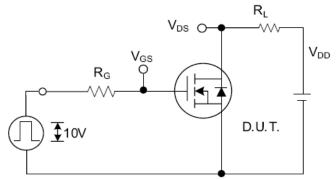


Fig. 2.1 Switching Test Circuit

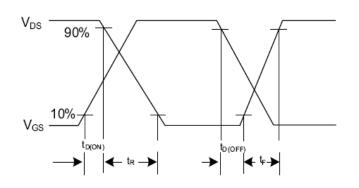


Fig. 2.2 Switching Waveforms

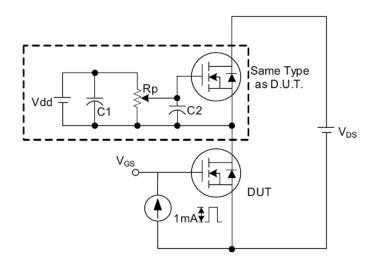


Fig. 3 . 1 Gate Charge Test Circuit

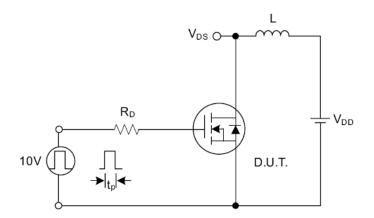


Fig. 4.1 Unclamped Inductive Switching Test Circuit

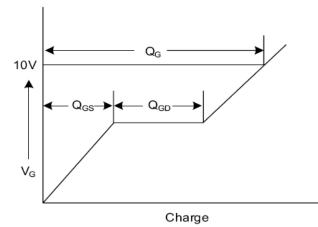
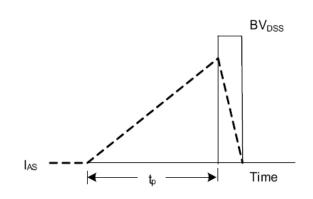
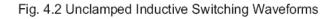


Fig. 3.2 Gate Charge Waveform





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