500V N-Channel MOSFET

Lead Free Package and Finish

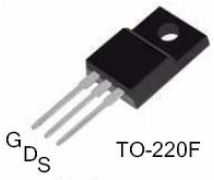
BV_{DSS}	$R_{DS(ON),typ.}$	I_D
500V	0.55Ω	9A

General Features

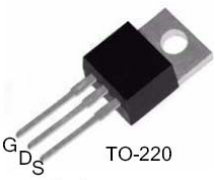
- Proprietary New Planar Technology
- $R_{DS(ON),typ.}$=0.55 Ω@V_{GS}=10V
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

Applications

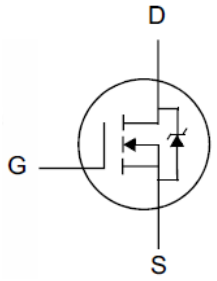
- Adaptor Charger
- SMPS Power Supply
- LCD Panel Power



Packages
Not to Scale



Packages
Not to Scale



Ordering Information

Part Number	Package	Brand
PTP09N50	TO-220	
PTA09N50	TO-220F	

Absolute Maximum Ratings

T_C=25℃ unless otherwise specified

Symbol	Parameter	PTP09N50	PTA09N50	Unit
V_{DSS}	Drain-to-Source Voltage[1]	500		V
V_{GSS}	Gate-to-Source Voltage	±30		
I_D	Continuous Drain Current	9.0		A
$I_{D\ @\ Tc\ =100℃}$	Continuous Drain Current @ Tc=100℃	Figure 3		
I_{DM}	Pulsed Drain Current at V_{GS}=10V[2]	Figure 6		
E_{AS}	Single Pulse Avalanche Energy	630		mJ
dv/dt	Peak Diode Recovery dv/dt[3]	5.0		V/ns
P_D	Power Dissipation	140	50	W
	Derating Factor above 25℃	1.12	0.40	W/℃
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		℃
T_J& T_{STG}	Operating and Storage Temperature Range	-55 to 150		

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

Thermal Characteristics

Symbol	Parameter	PTP09N50	PTA09N50	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.89	2.5	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62	100	

Electrical Characteristics

OFF Characteristics

T_J =25℃ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	500	--	--	V	V_{GS}=0V, I_D=250uA
I_{DSS}	Drain-to-Source Leakage Current	--	--	1	uA	V_{DS}=500V, V_{GS}=0V
		--	--	100		V_{DS}=400V, V_{GS}=0V, T_J =125℃
I_{GSS}	Gate-to-Source Leakage Current	--	--	+100	nA	V_{GS}=+30V, V_{DS}=0V
		--	--	-100		V_{GS}=-30V, V_{DS}=0V

ON Characteristics

T_J =25℃ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance[4]	--	0.55	0.75	Ω	V_{GS}=10V, I_D=5A
$V_{GS(TH)}$	Gate Threshold Voltage	2.0	--	4.0	V	V_{DS}=V_{GS}, I_D=250uA
gfs	Forward Transconductance[4]	--	11	--	S	VDS=20V,ID=9A

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{iss}	Input Capacitance	--	1253	--	pF	V_{GS}=0V, V_{DS}=25V, f=1.0MHz
C_{rss}	Reverse Transfer Capacitance	--	18	--		
C_{oss}	Output Capacitance	--	130	--		
Q_g	Total Gate Charge	--	28	--	nC	V_{DD}=250V, I_D=9A, V_{GS}=0 to 10V
Q_{gs}	Gate-to-Source Charge	--	7.0	--		
Q_{gd}	Gate-to-Drain (Miller) Charge	--	11	--		

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	18	--	nS	V_{DD}=250V, I_D=9A, V_{GS}= 10V R_G=25 Ω
t_{rise}	Rise Time	--	32	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	80	--		
t_{fall}	Fall Time	--	38	--		

Source-Drain Body Diode Characteristics

T_J=25℃ unless otherwise specified

Symbol	Parameter	Min	Typ.	Max.	Unit	Test Conditions
I_{SD}	Continuous Source Current[4]	--	--	9	A	Integral PN-diode in MOSFET
I_{SM}	Pulsed Source Current[4]	--	--	36		
V_{SD}	Diode Forward Voltage	--	--	1.5	V	I_S=9A, V_{GS}=0V
trr	Reverse recovery time	--	330	--	ns	V_{GS}=0V ,I_F=9A, di_F/dt=100A/μs
Qrr	Reverse recovery charge	--	1.5	--	uC	

Note:

[1] T_J=+25℃ to +150℃
[2] Repetitive rating; pulse width limited by maximum junction temperature.
[3] I_{SD}= 9A di/dt < 100 A/μs, V_{DD} < BV_{DSS}, T_J=+150℃.
[4] Pulse width≤380μs; duty cycle≤2%.

Typical Characteristics

Figure 1. Maximum Effective Thermal Impedance, Junction-to-Case

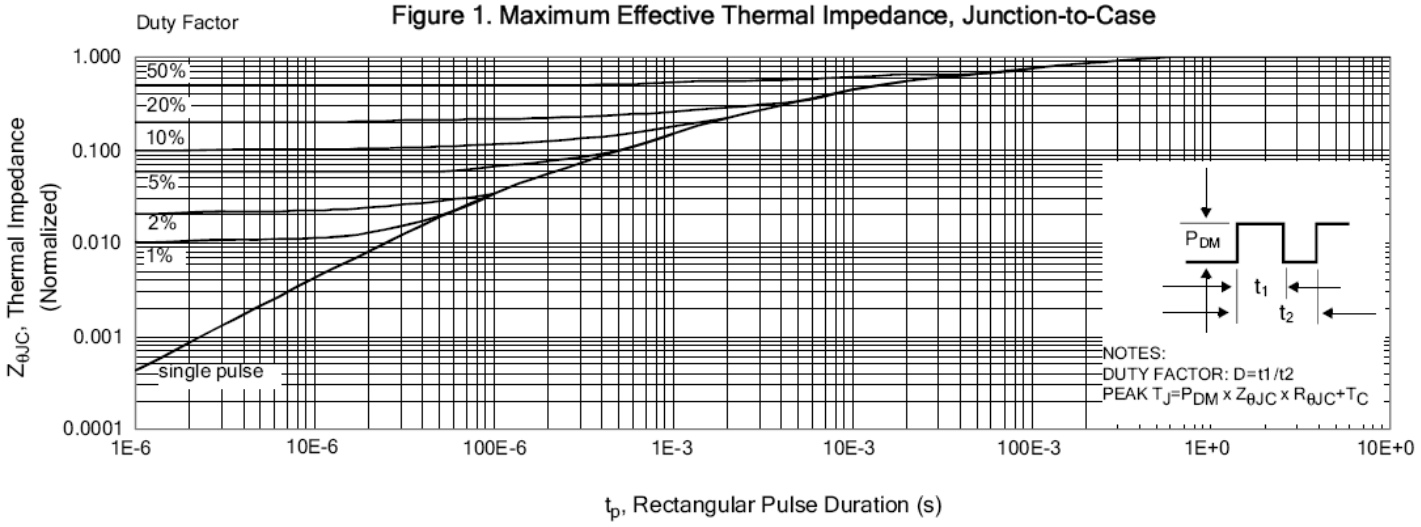


Figure 2. Maximum Power Dissipation vs Case Temperature

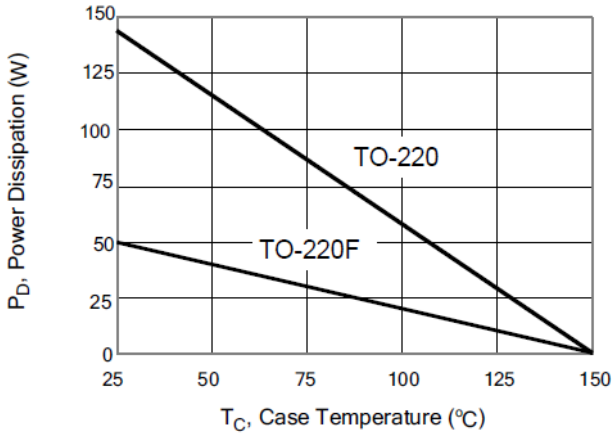


Figure 3. Maximum Continuous Drain Current vs Case Temperature

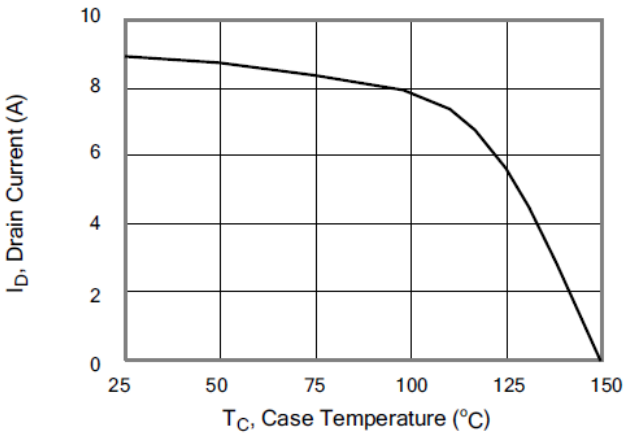


Figure 4. Typical Output Characteristics

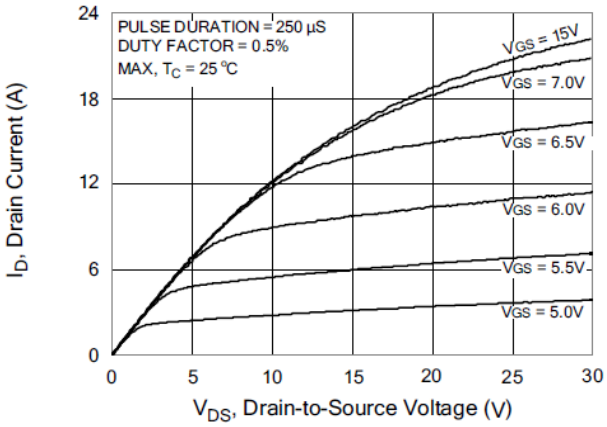
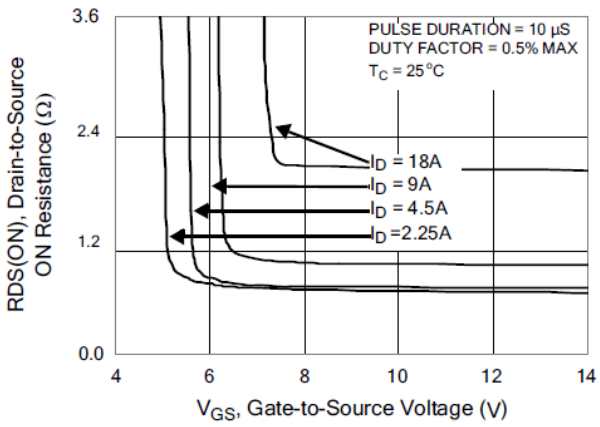


Figure 5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current



Typical Characteristics(Cont.)

Figure 6. Maximum Peak Current Capability

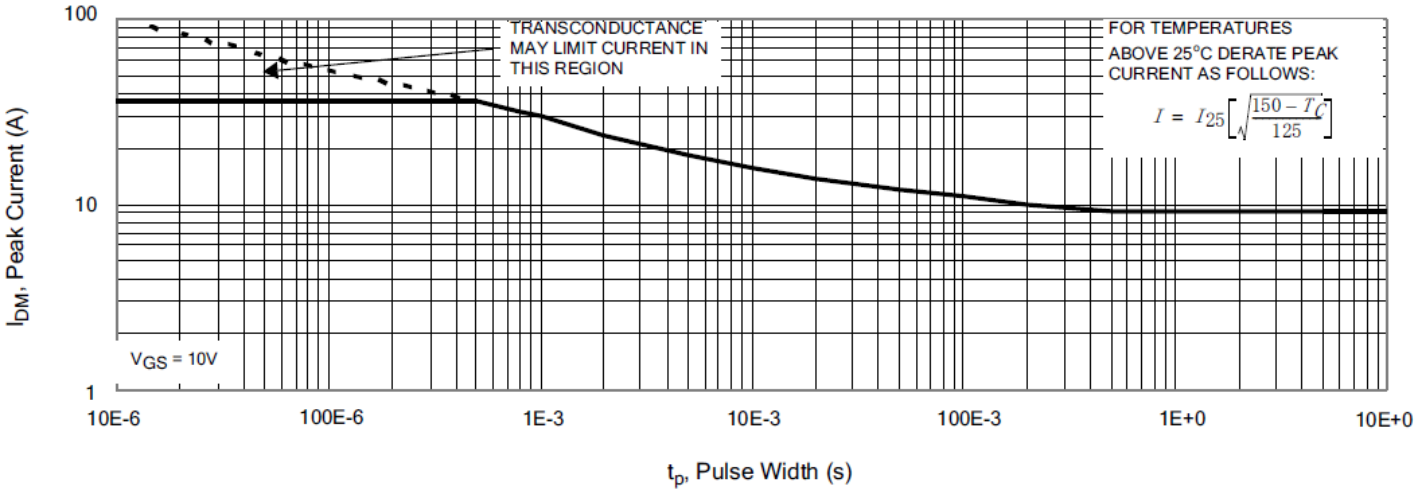


Figure 7. Typical Transfer Characteristics

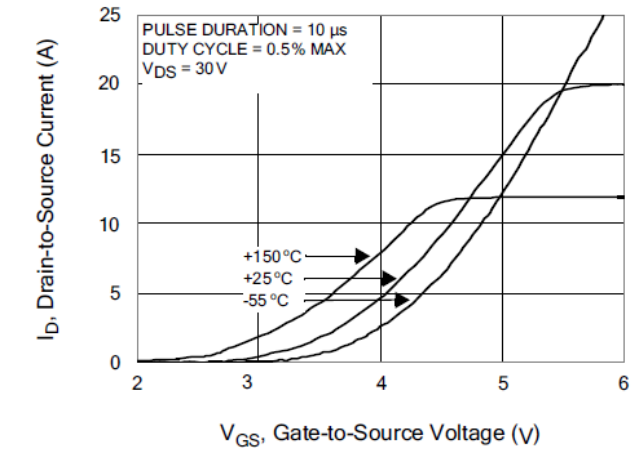


Figure 8. Unclamped Inductive Switching Capability

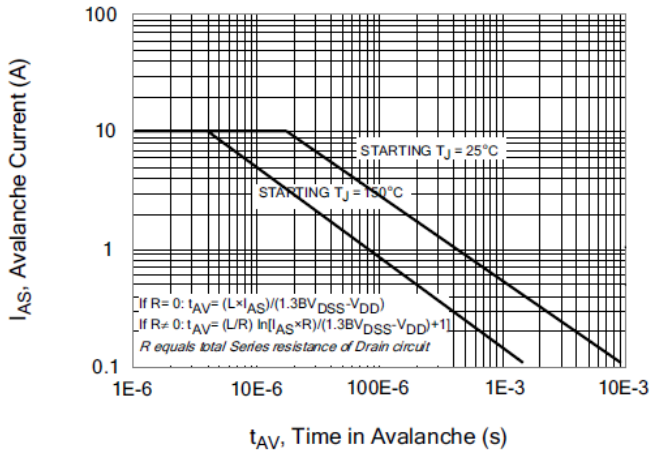


Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current

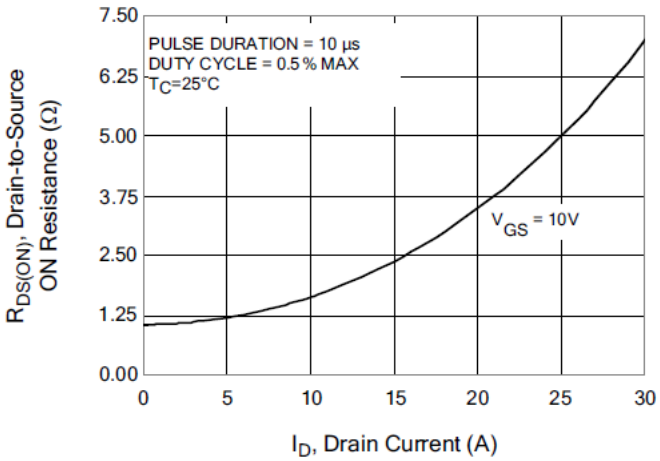
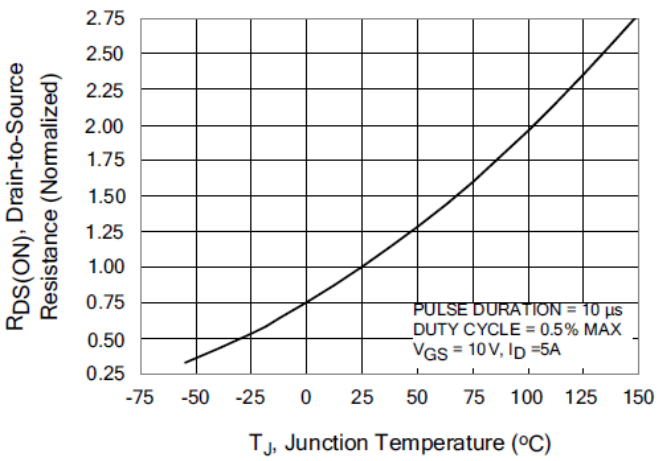


Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature



Typical Characteristics(Cont.)

Figure 11. Typical Breakdown Voltage vs Junction Temperature

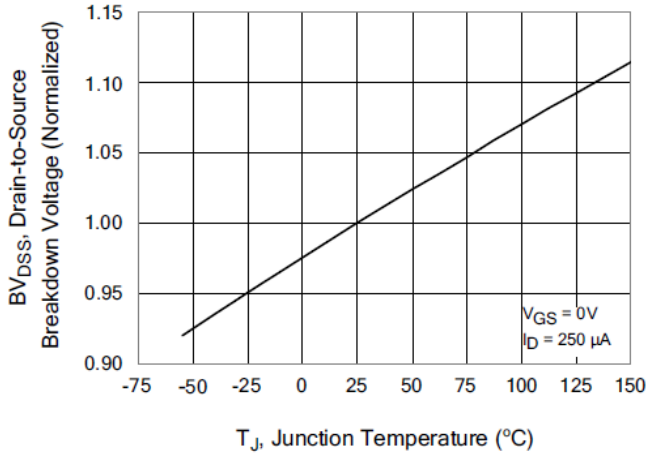


Figure 12. Typical Threshold Voltage vs Junction Temperature

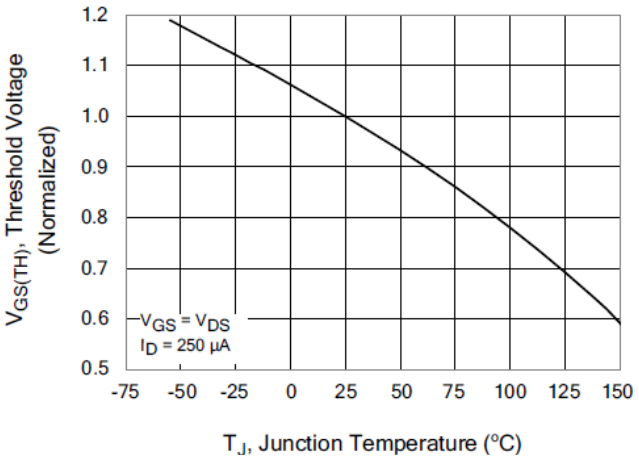


Figure 13. Maximum Forward Bias Safe Operating Area

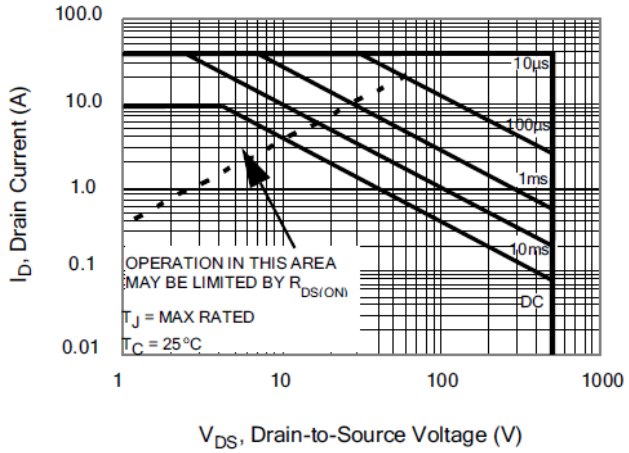


Figure 14. Typical Capacitance vs Drain-to-Source Voltage

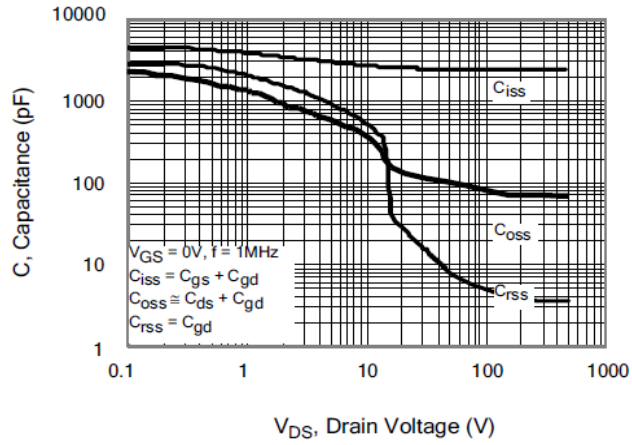


Figure 15. Typical Gate Charge vs Gate-to-Source Voltage

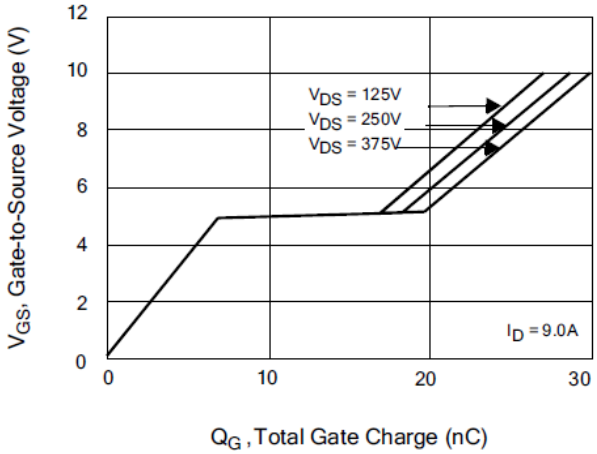
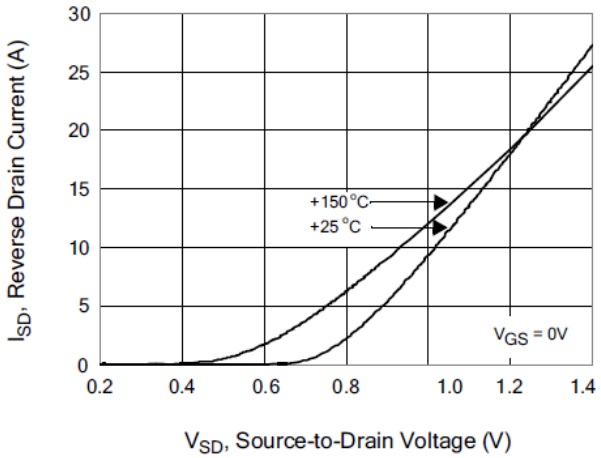


Figure 16. Typical Body Diode Transfer Characteristics



Test Circuits and Waveforms

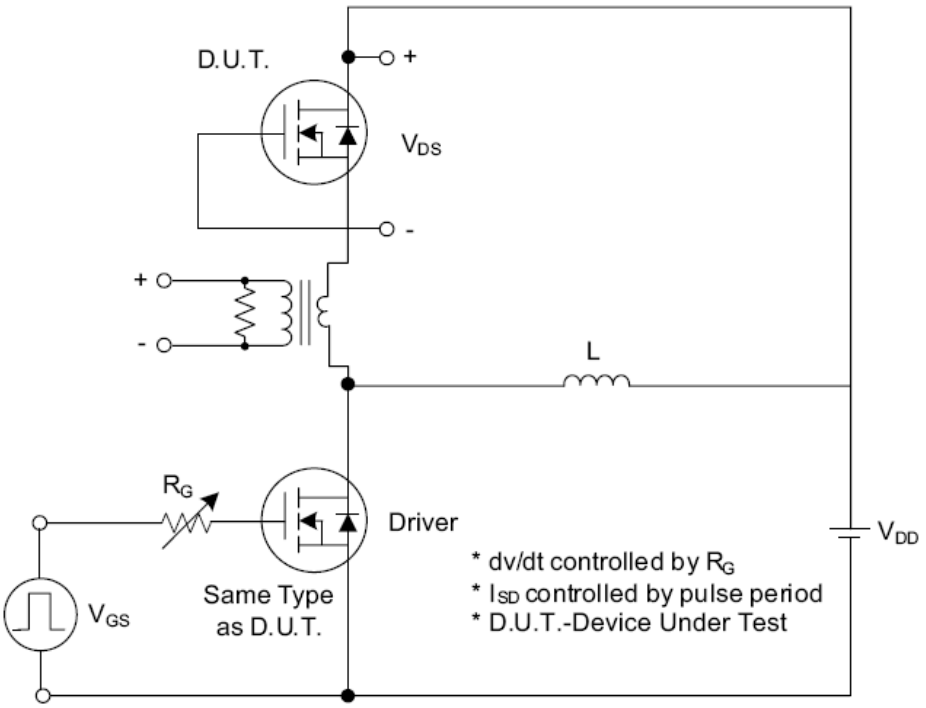


Fig. 1.1 Peak Diode Recovery dv/dt Test Circuit

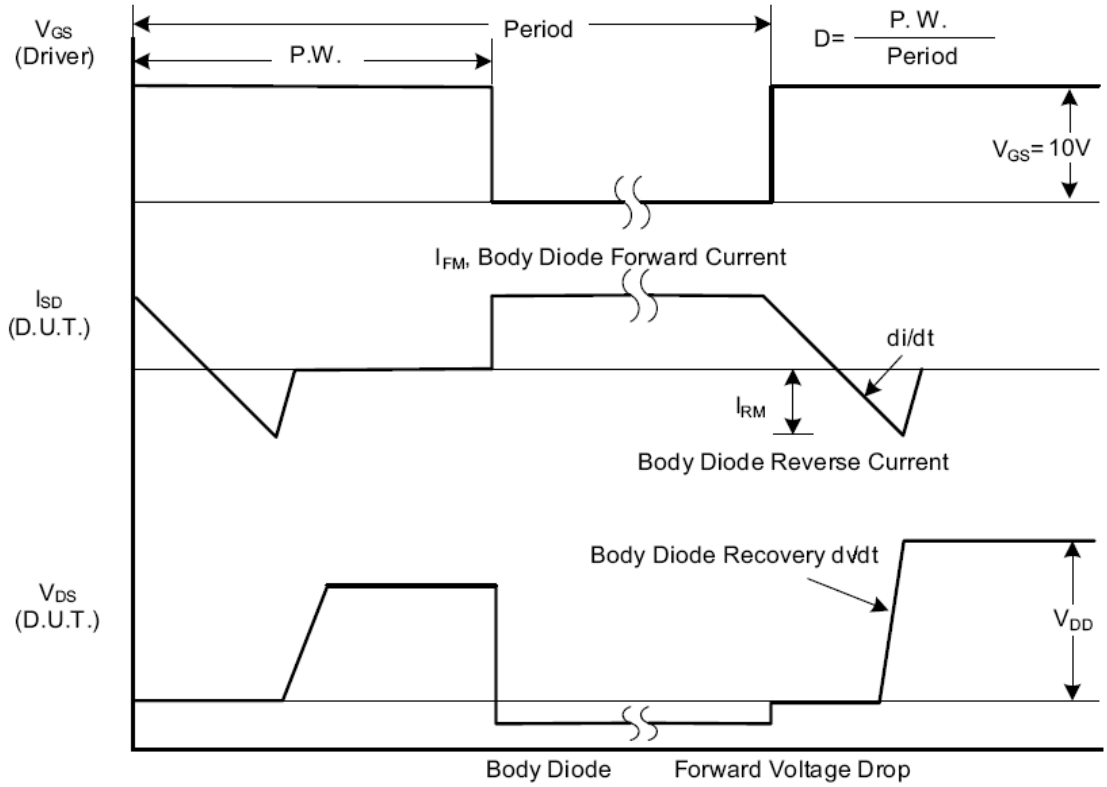


Fig. 1.2 Peak Diode Recovery dv/dt Waveforms

Test Circuits and Waveforms (Cont.)

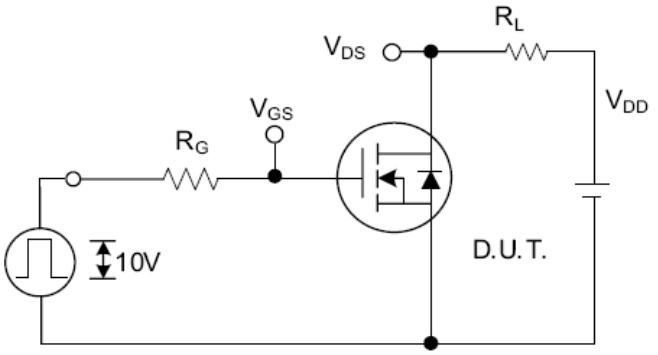


Fig. 2.1 Switching Test Circuit

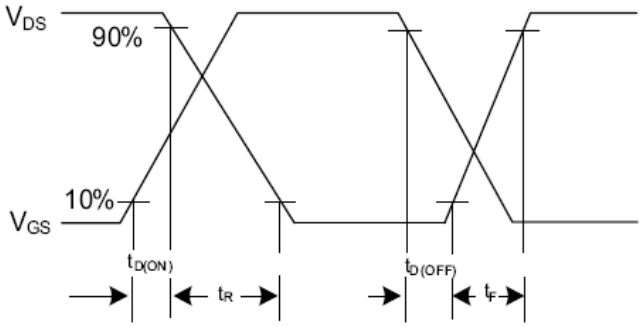


Fig. 2.2 Switching Waveforms

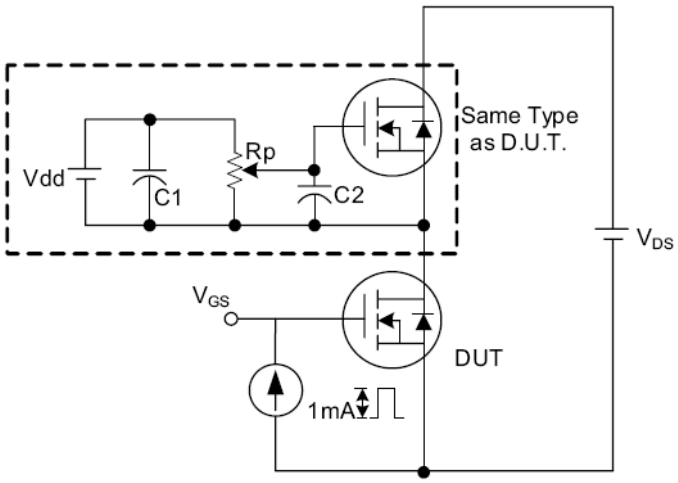


Fig. 3 . 1 Gate Charge Test Circuit

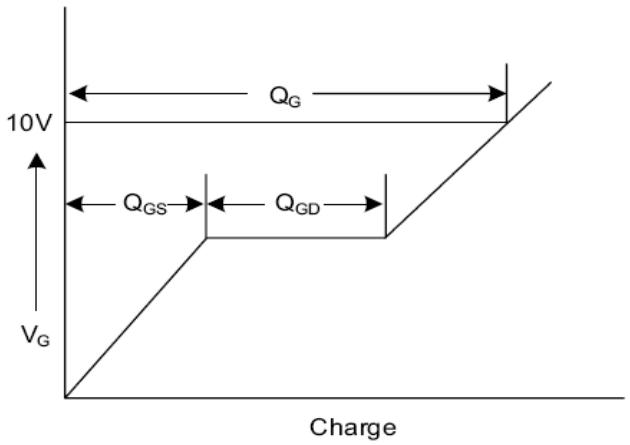


Fig. 3 . 2 Gate Charge Waveform

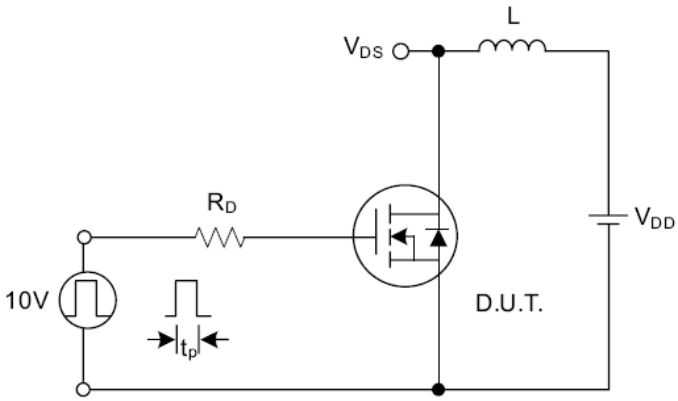


Fig. 4.1 Unclamped Inductive Switching Test Circuit

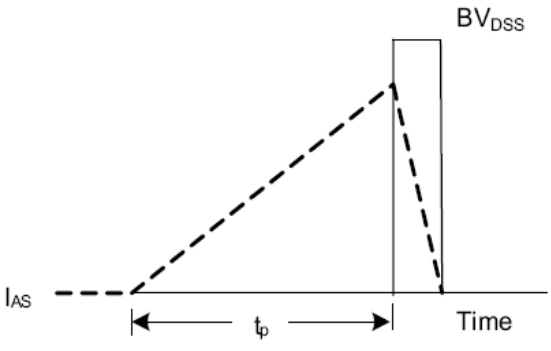


Fig. 4.2 Unclamped Inductive Switching Waveforms

Disclaimers:

Perfect Intelligent Power Semiconductor Co., Ltd (PIP) reserves the right to make changes without notice in order to improve reliability, function or design and to discontinue any product or service without notice. Customers should obtain the latest relevant information before orders and should verify that such information is current and complete. All products are sold subject to PIP's terms and conditions supplied at the time of order acknowledgement.

Perfect Intelligent Power Semiconductor Co., Ltd warrants performance of its hardware products to the specifications at the time of sale, Testing, reliability and quality control are used to the extent PIP deems necessary to support this warrantee. Except where agreed upon by contractual agreement, testing of all parameters of each product is not necessarily performed.

Perfect Intelligent Power Semiconductor Co., Ltd does not assume any liability arising from the use of any product or circuit designs described herein. Customers are responsible for their products and applications using PIP's components. To minimize risk, customers must provide adequate design and operating safeguards.

Perfect Intelligent Power Semiconductor Co., Ltd does not warrant or convey any license either expressed or implied under its patent rights, nor the rights of others. Reproduction of information in PIP's data sheets or data books is permissible only if reproduction is without modification or alteration. Reproduction of this information with any alteration is an unfair and deceptive business practice. Perfect Intelligent Power Semiconductor Co., Ltd is not responsible or liable for such altered documentation.

Resale of PIP's products with statements different from or beyond the parameters stated by Perfect Intelligent Power Semiconductor Co., Ltd for that product or service voids all express or implied warrantees for the associated PIP's product or service and is unfair and deceptive business practice. Perfect Intelligent Power Semiconductor Co., Ltd is not responsible or liable for any such statements.

Life Support Policy:

Perfect Intelligent Power Semiconductor Co., Ltd's products are not authorized for use as critical components in life support devices or systems without the expressed written approval of Perfect Intelligent Power Semiconductor Co., Ltd.

As used herein:

1. Life support devices or systems are devices or systems which:
   a. are intended for surgical implant into the human body,
   b. support or sustain life,
   c. whose failure to perform when properly used in accordance with instructions for used provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.
