650V N-ch Super-Junction MOSFET

Pb Lead Free Package and Finish

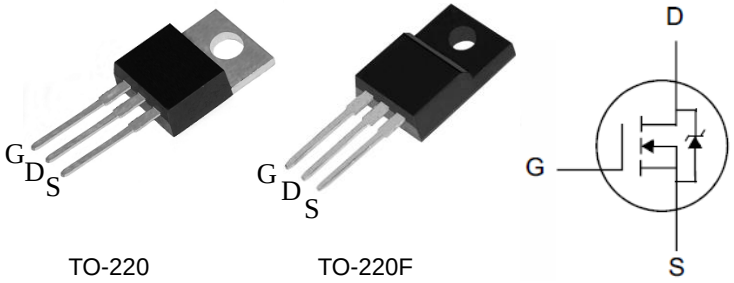
$BV_{DSS@\ T_{J=150℃}}$	$R_{DS(ON),typ.}$	I_D
700V	0.16Ω	20A

General Features

- Proprietary New Super-Junction Technology
- $R_{DS(ON),typ.}$=0.16 Ω@V_{GS}=10V
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

Applications

- Adaptor
- Charger
- SMPS Standby Power



TO-220 TO-220F

Package Not to Scale

Ordering Information

Part Number	Package	Brand
SPTP65R160	TO-220	
SPTA65R160	TO-220F	

Absolute Maximum Ratings

T_C=25℃ unless otherwise specified

Symbol	Parameter	Value		Unit
		SPTP65R160	SPTA65R160	
V_{DSS}	Drain-to-Source Voltage	650		V
V_{GSS}	Gate-to-Source Voltage	±30		
I_D	Continuous Drain Current	20		A
I_{DM}	Pulsed Drain Current at V_{GS}=10V[1]	60		
E_{AS}	Single Pulse Avalanche Energy[2]	800		mJ
P_D	Power Dissipation	176	34	W
T_L	Soldering Temperature Distance of 1.6mm from case for 10 seconds	300		℃
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	Max. Value		Unit
		SPTP65R160	SPTA65R160	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.71	3.67	℃/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	650	--	--	V	V_{GS}=0V, I_D=250uA
I_{DSS}	Drain-to-Source Leakage Current	--	--	1	uA	V_{DS}=650V, V_{GS}=0V
		--	--	100		V_{DS}=520V, 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[3]	--	0.16	0.18	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[3]	--	19	--	S	V_{DS}=10V,I_D=20A

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{iss}	Input Capacitance	--	1600	--	pF	V_{GS}=0V, V_{DS}=50V, f=1.0MH_Z
C_{rss}	Reverse Transfer Capacitance	--	15	--		
C_{oss}	Output Capacitance	--	220	--		
Q_g	Total Gate Charge	--	40	--	nC	V_{DD}=520V, I_D=20A, V_{GS}=0 to 10V
Q_{gs}	Gate-to-Source Charge	--	7.5	--		
Q_{gd}	Gate-to-Drain (Miller) Charge	--	15	--		

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	15	--	nS	V_{DD}=400V, I_D=20A, V_{GS}=10V Rg=25 Ω
t_{rise}	Rise Time	--	15	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	95	--		
t_{fall}	Fall Time	--	10	--		

Source-Drain Body Diode Characteristics

T_J=25℃ unless otherwise specified

Symbol	Parameter	Min	Typ.	Max.	Unit	Test Conditions
I_{SD}	Continuous Source Current[2]	--	--	20	A	Maximum Ratings
I_{SM}	Pulsed Source Current[2]	--	--	60		
V_{SD}	Diode Forward Voltage	--	0.95	1.2	V	I_S=20A, V_{GS}=0V
t_{rr}	Reverse Recovery Time	--	450	--	ns	V_R=480V,V_{GS}=0V I_F= I_S, di/dt =100A/μs
Q_{rr}	Reverse Recovery Charge	--	8.0	--	uC	

Note:

[1] Repetitive Rating: Pulse width limited by maximum junction temperature
[2] L = 10mH, VDD= 50V, Starting T_J= 25°C
[3] Pulse Test: Pulse width ≤ 380us, Duty Cycle≤ 2%

Typical Characteristics

Figure 1. Output Characteristics

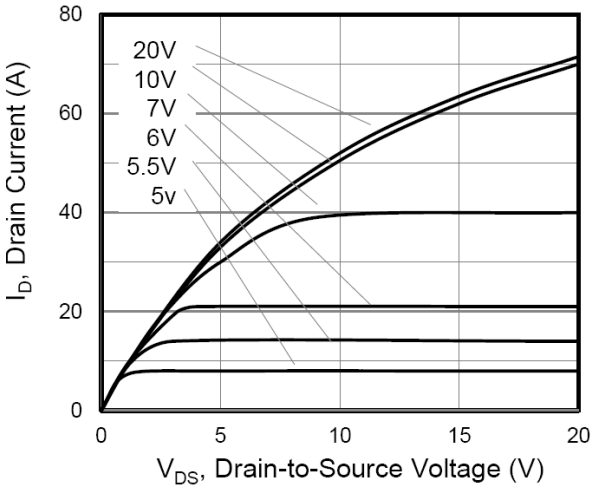


Figure 2. Transfer Characteristics

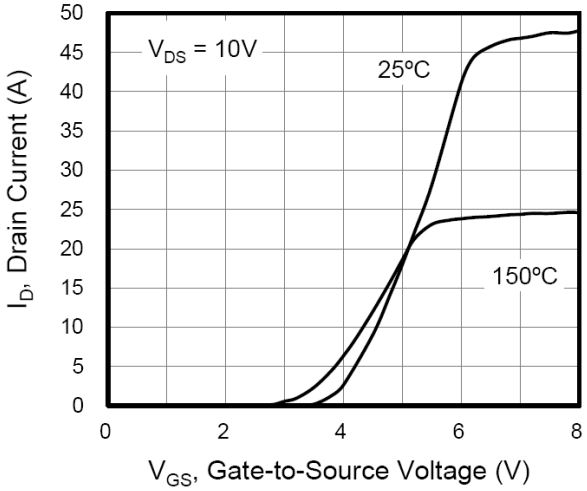


Figure 3. On-Resistance vs. Drain Current

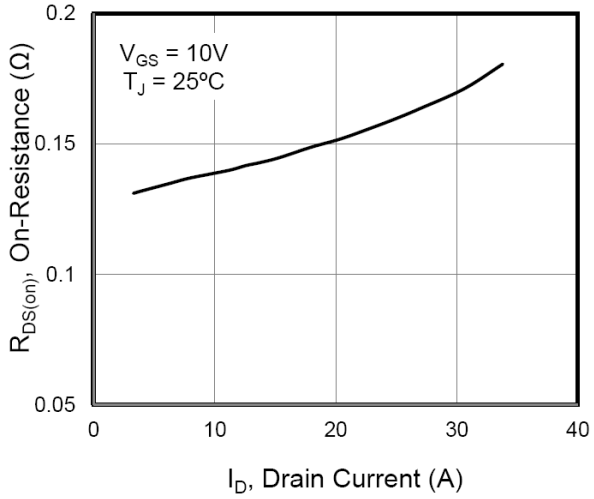


Figure 4. Capacitance

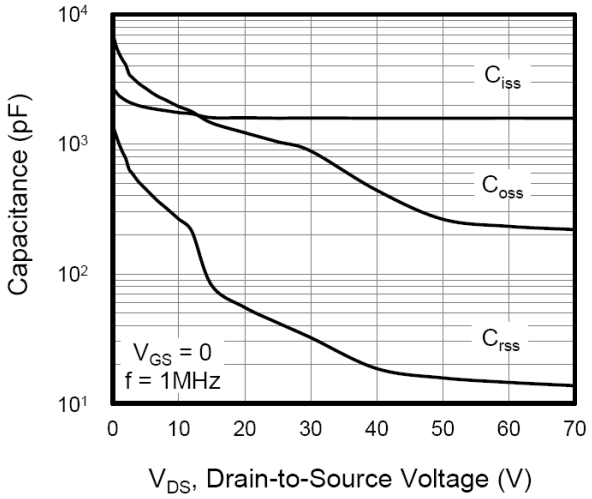


Figure 5. Gate Charge

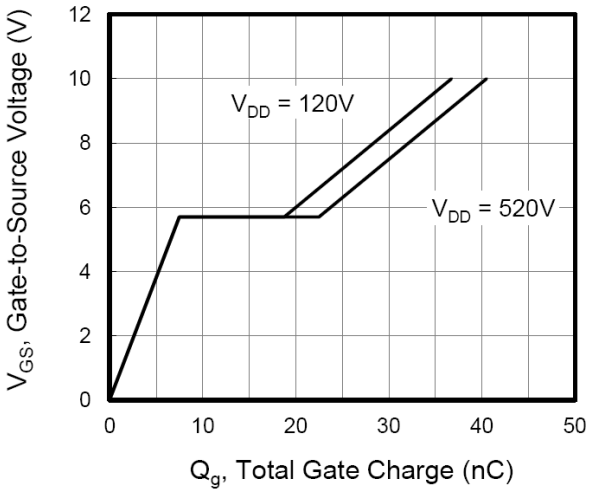
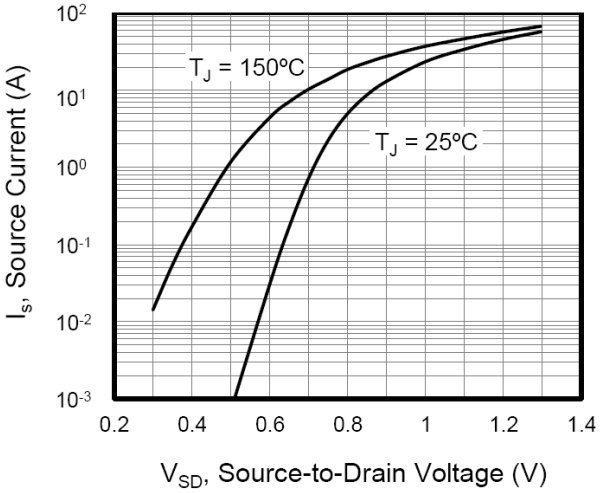


Figure 6. Body Diode Forward Voltage



Typical Characteristics(Cont.)

Figure 7. On-Resistance vs. Junction Temperature

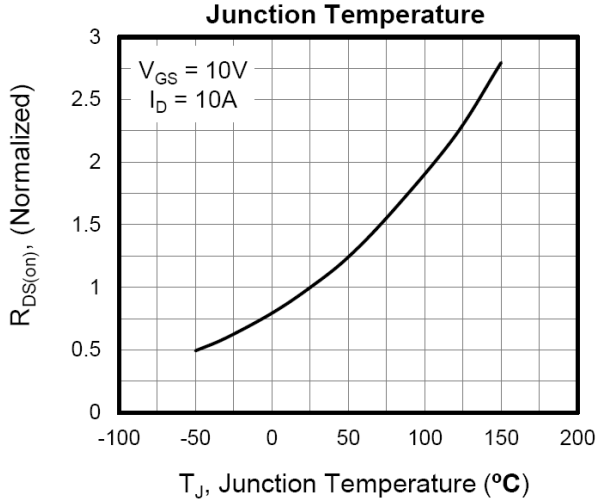


Figure 8. Threshold Voltage vs. Junction Temperature

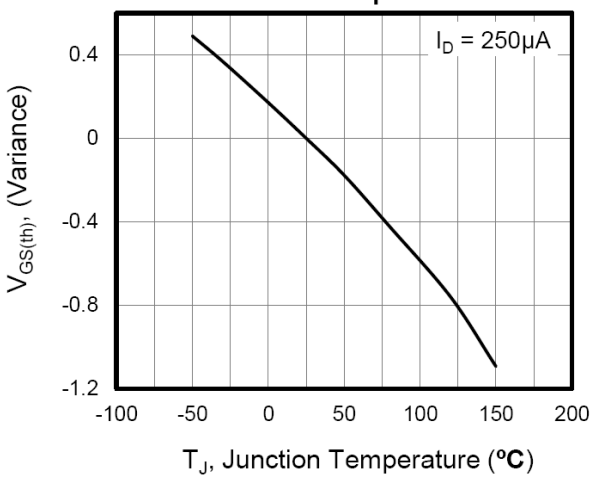


Figure 9. Transient Thermal Impedance TO-220

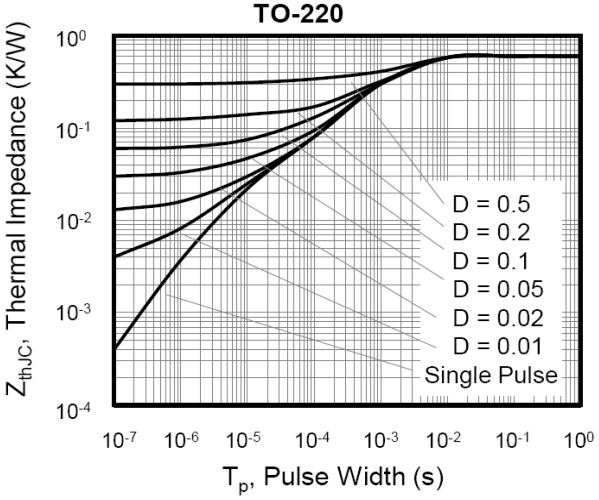
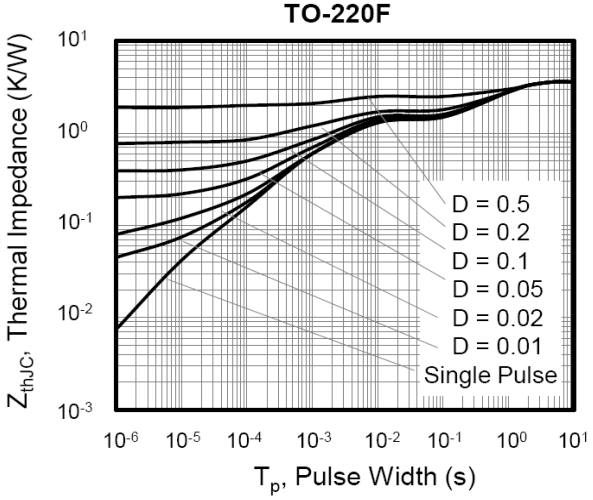


Figure 10. Transient Thermal Impedance TO-220F



Test Circuits and Waveforms

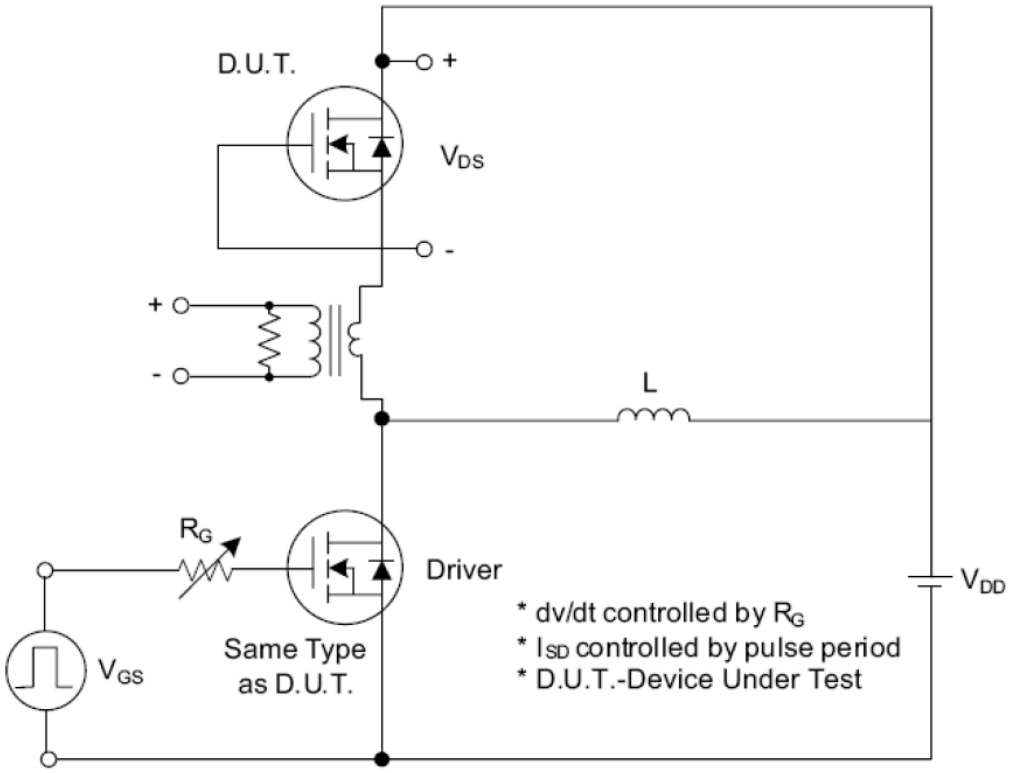


Fig. 1.1 Peak Diode Recovery dv/dt Test Circuit

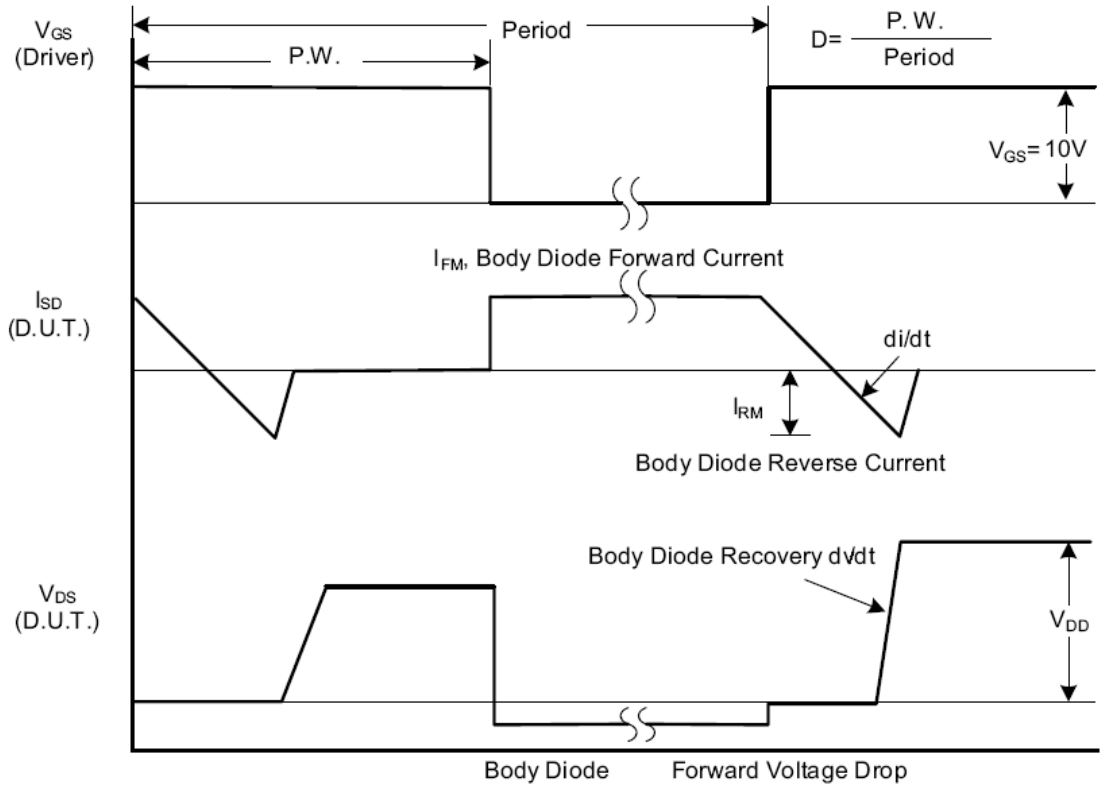


Fig. 1.2 Peak Diode Recovery dv/dt Waveforms

Test Circuits and Waveforms (Cont.)

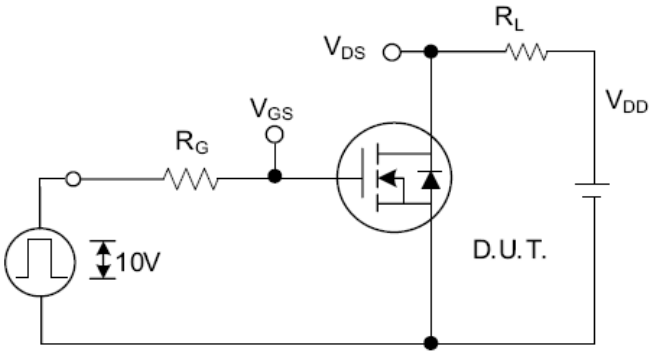


Fig. 2.1 Switching Test Circuit

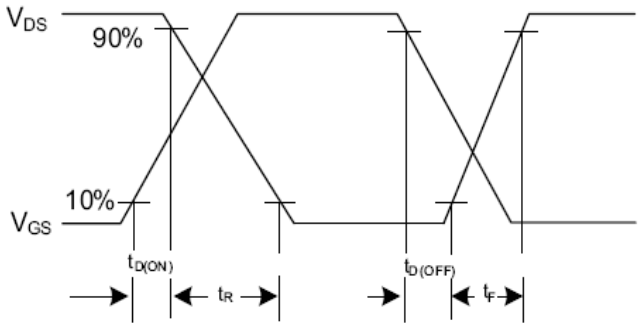


Fig. 2.2 Switching Waveforms

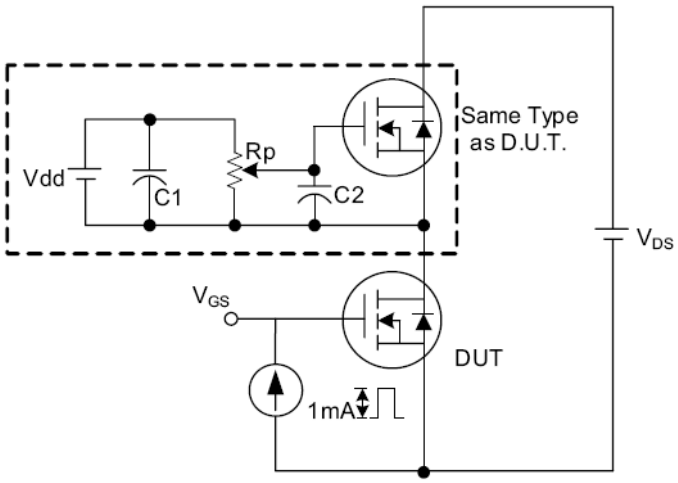


Fig. 3 . 1 Gate Charge Test Circuit

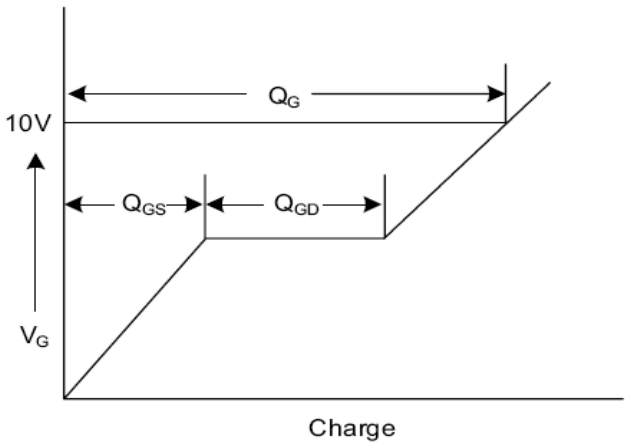


Fig. 3 . 2 Gate Charge Waveform

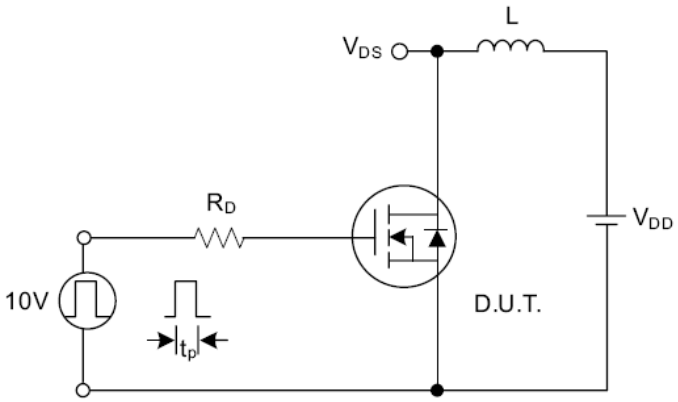


Fig. 4.1 Unclamped Inductive Switching Test Circuit

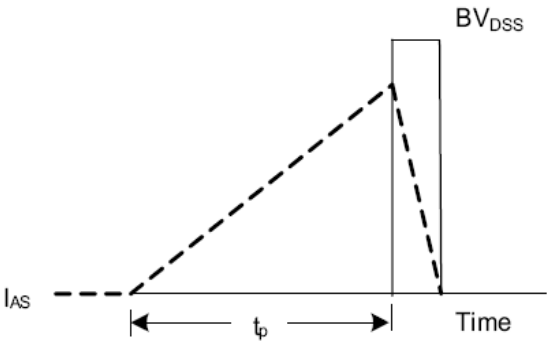


Fig. 4.2 Unclamped Inductive Switching Waveforms

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.
