650V N-ch Planar MOSFET

Lead Free Package and Finish

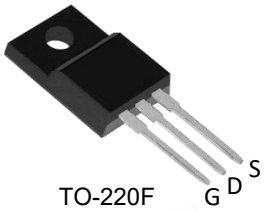
BV_{DSS}	$R_{DS(ON),typ.}$	I_D
650V	2.4Ω	4.0A

General Features

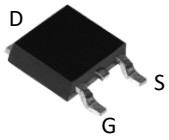
- RoHS Compliant
- $R_{DS(ON),typ.}$=2.4 Ω@V_{GS}=10V
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

Applications

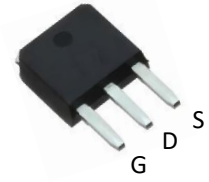
- Adaptor
- Charger
- SMPS Standby Power



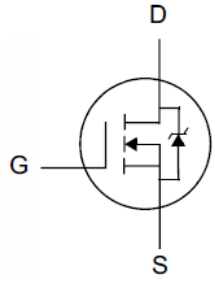
TO-220F



TO-252



TO-251



Package No to Scale

Ordering Information

Part Number	Package	Brand
PTA04N65F	TO-220F	
PTD04N65C	TO-252	
PTU04N65F	TO-251	

Absolute Maximum Ratings

T_C=25℃ unless otherwise specified

Symbol	Parameter	PTA04N65F	PTD04N65C PTU04N65F	Unit
V_{DSS}	Drain-to-Source Voltage	650		V
V_{GSS}	Gate-to-Source Voltage	±30		
I_D	Continuous Drain Current	4.0		A
I_{DM}	Pulsed Drain Current at V_{GS}=10V	16		
E_{AS}	Single Pulse Avalanche Energy	70		mJ
P_D	Power Dissipation	24	72	W
	Derating Factor above 25℃	0.19	0.58	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	PTA04N65F	PTD04N65C PTU04N65F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	5.2	1.7	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	100	75	

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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	--	--	+0.1	uA	V_{GS}=+30V, V_{DS}=0V
		--	--	-0.1		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	--	2.4	3.0	Ω	V_{GS}=10V, I_D=2.0A
$V_{GS(TH)}$	Gate Threshold Voltage	2.0	--	4.0	V	V_{DS}=V_{GS}, I_D=250uA
gfs	Forward Transconductance	--	5.0	--	S	V_{DS}=15V,ID=2.0A

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{iss}	Input Capacitance	--	570	--	pF	V_{GS}=0V, V_{DS}=25V, f=1.0MHz
C_{rss}	Reverse Transfer Capacitance	--	3.0	--		
C_{oss}	Output Capacitance	--	42	--		
Q_g	Total Gate Charge	--	11	--	nC	V_{DD}=325V, I_D=4A, V_{GS}=0 to 10V
Q_{gs}	Gate-to-Source Charge	--	2.8	--		
Q_{gd}	Gate-to-Drain (Miller) Charge	--	3.8	--		

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}=325V, I_D=4A, V_{GS}=10V Rg=25Ω
t_{rise}	Rise Time	--	17	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	22	--		
t_{fall}	Fall Time	--	8.0	--		

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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]	--	--	4.0	A	Integral pn-diode in MOSFET
I_{SM}	Pulsed Source Current[2]	--	--	16		
V_{SD}	Diode Forward Voltage	--	--	1.5	V	I_S=4A, V_{GS}=0V
t_{rr}	Reverse Recovery Time	--	200	--	ns	V_{GS}=0V I_F= I_S, di/dt=100A/μs
Q_{rr}	Reverse Recovery Charge	--	820	--	nC	

Note:

[1] T_J=+25℃ to +150℃
[2] Pulse width≤380μs; duty cycle≤2%.

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Typical Characteristics

Figure 1. Maximum Transient Thermal Impedance

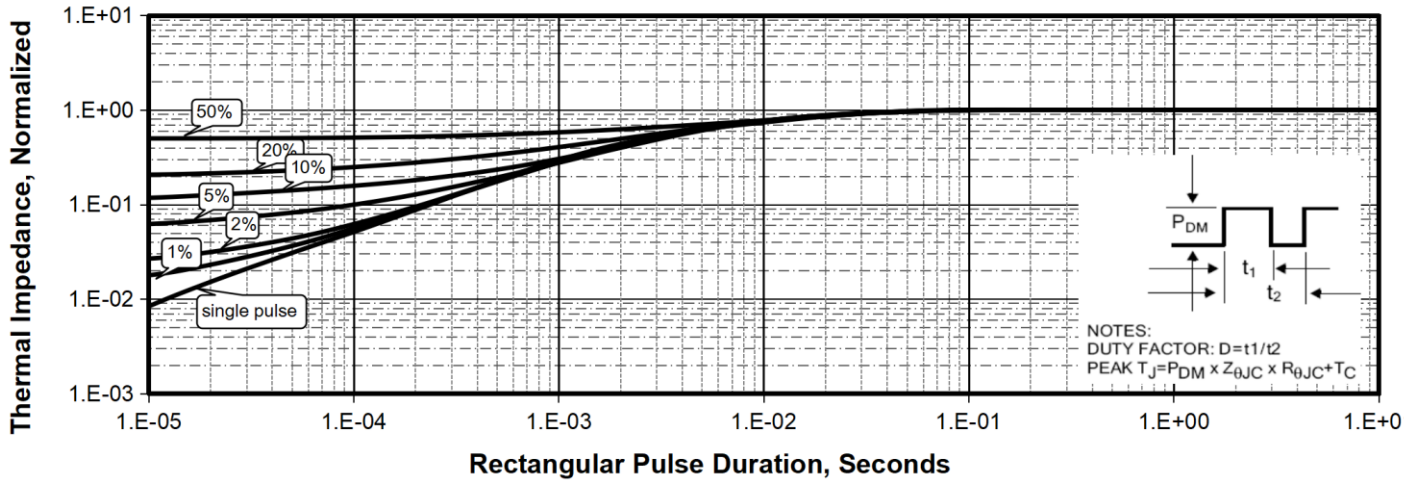


Figure 2 . Max. Power Dissipation vs Case Temperature

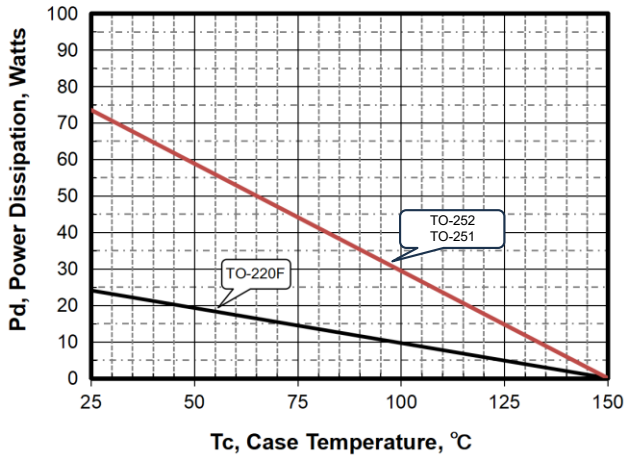


Figure 3 .Maximum Continuous Drain Current vs Tc

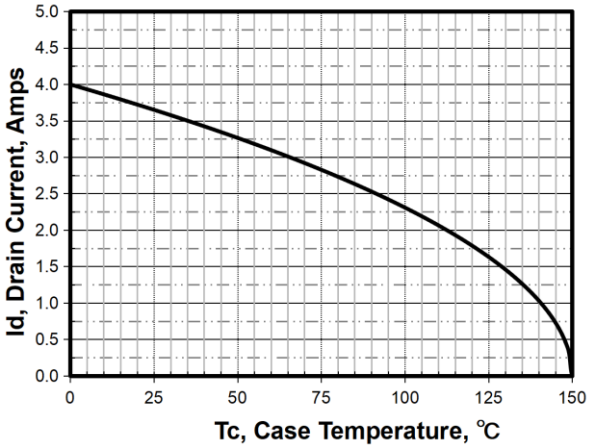


Figure 4. Typical Output Characteristics

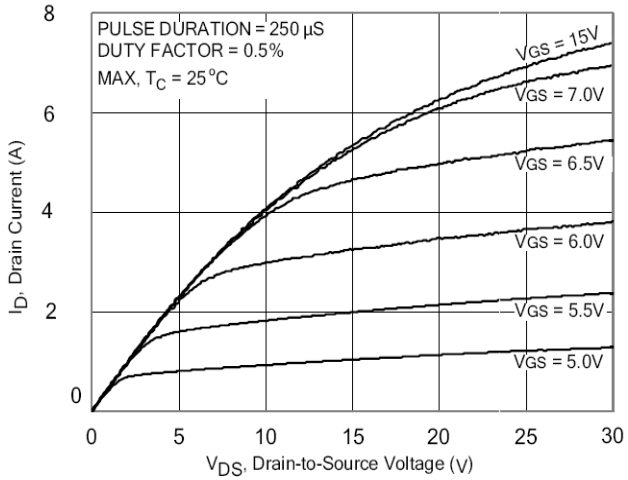
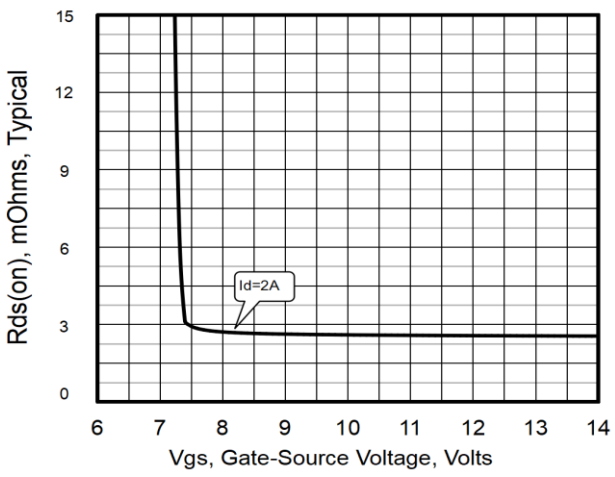


Figure 5. Rdson vs Gate Voltage



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Typical Characteristics(Cont.)

Figure 6. Maximum Peak Current Capability

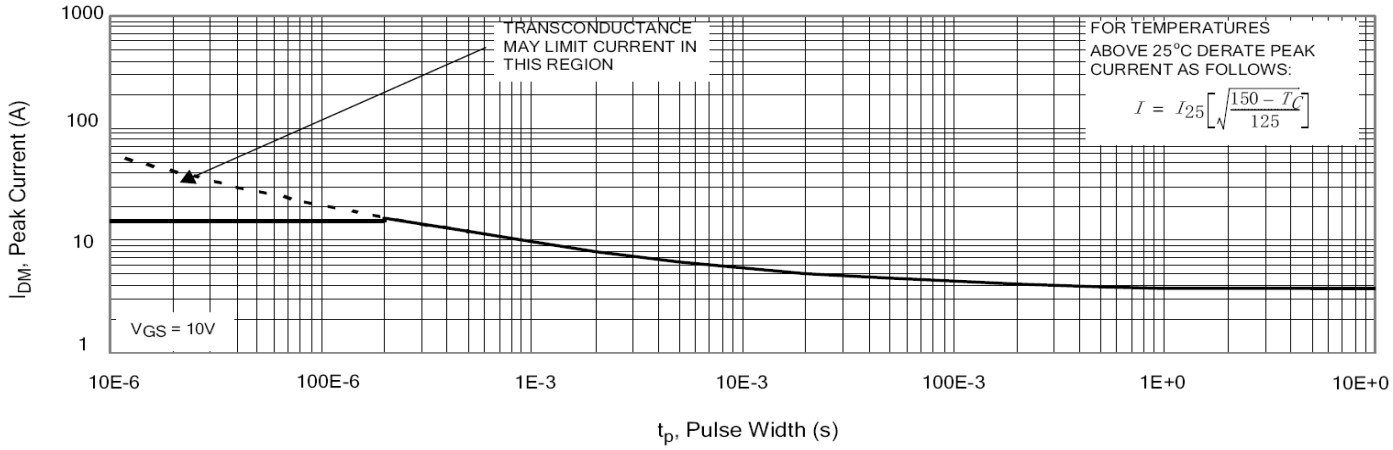


Figure 7. Typical Transfer Characteristics

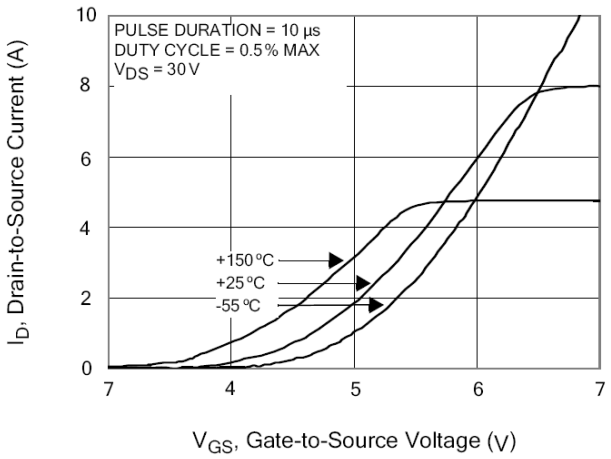


Figure 8. Unclamped Inductive Switching Capability

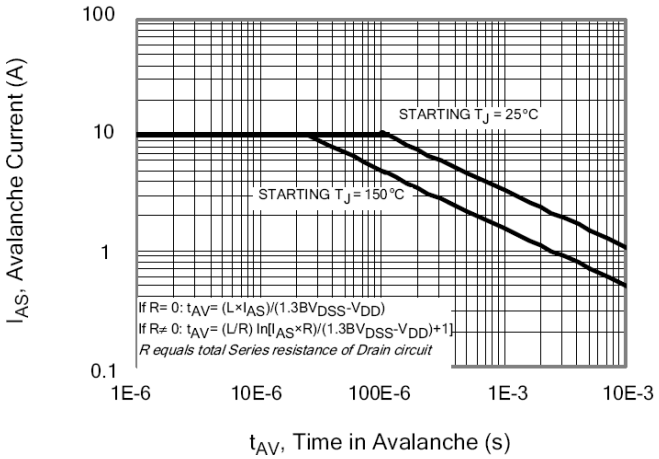


Figure 9. Drain to Source ON Resistance vs Drain Current

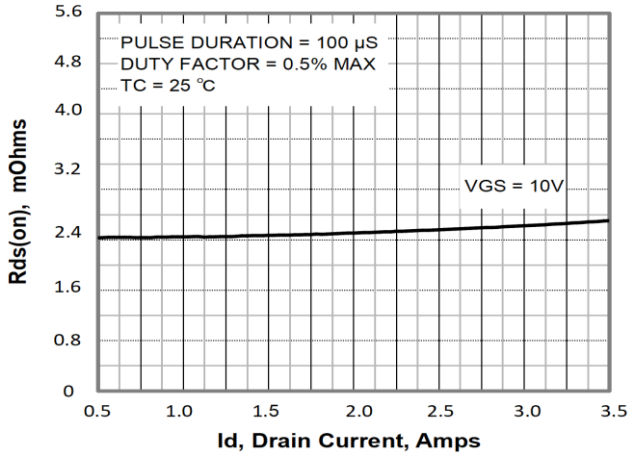
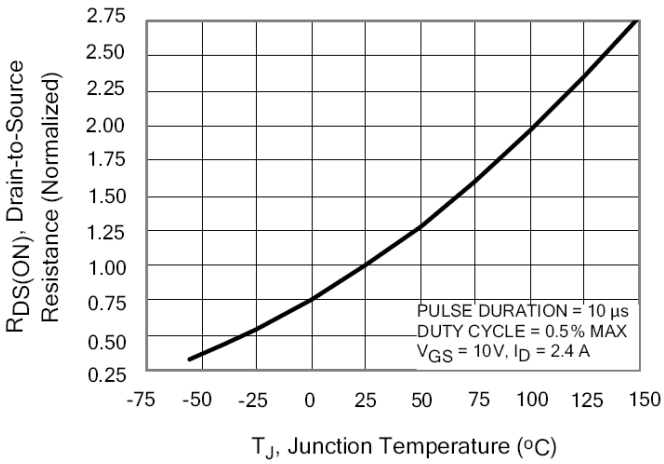


Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature



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Typical Characteristics(Cont.)

Figure 11. Typical Breakdown Voltage vs Junction Temperature

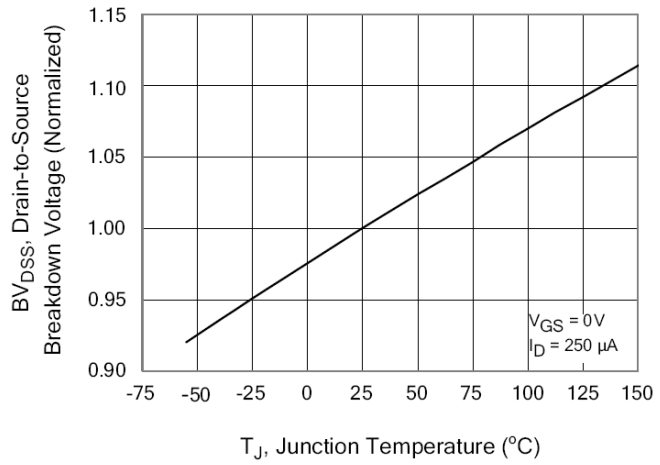


Figure 12. Typical Threshold Voltage vs Junction Temperature

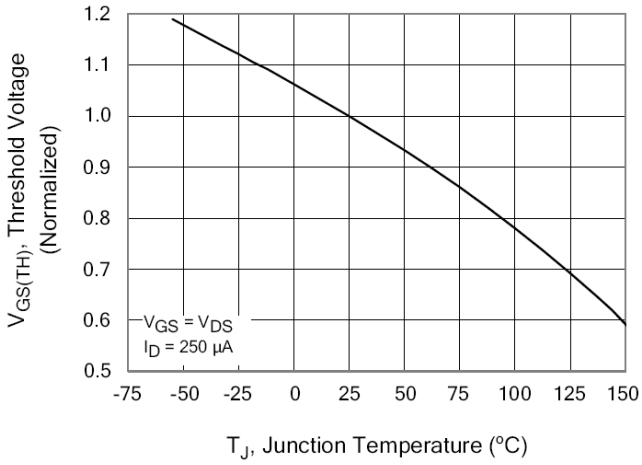


Figure 13 . Maximum Safe Operating Area TO-252 TO-251

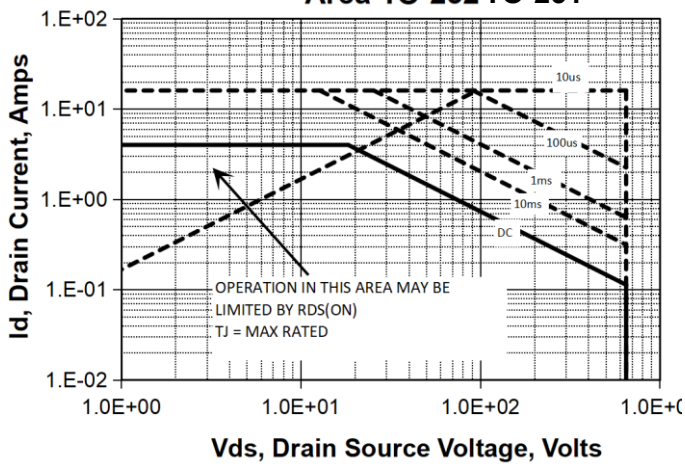


Figure 14 . Maximum Safe Operating Area TO-220F

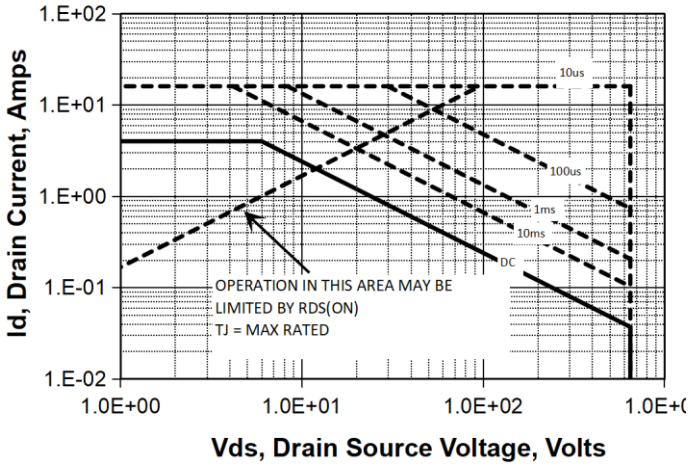


Figure 15 .Typical Gate Charge

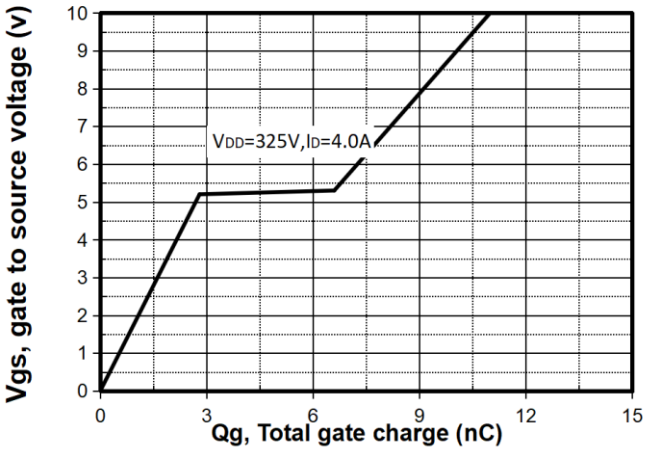
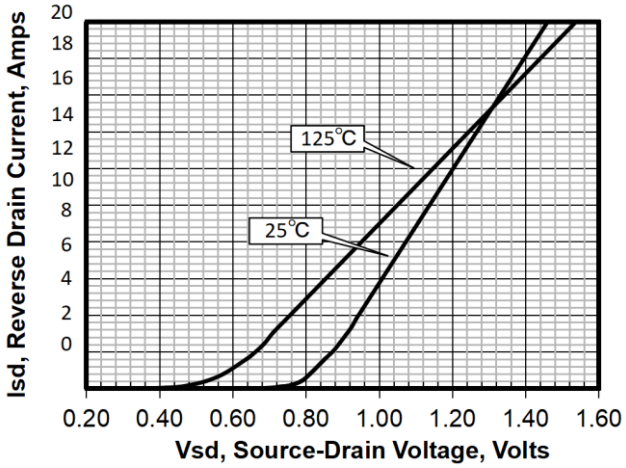


Figure 16.Body Diode Transfer Characteristics



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Test Circuits and Waveforms

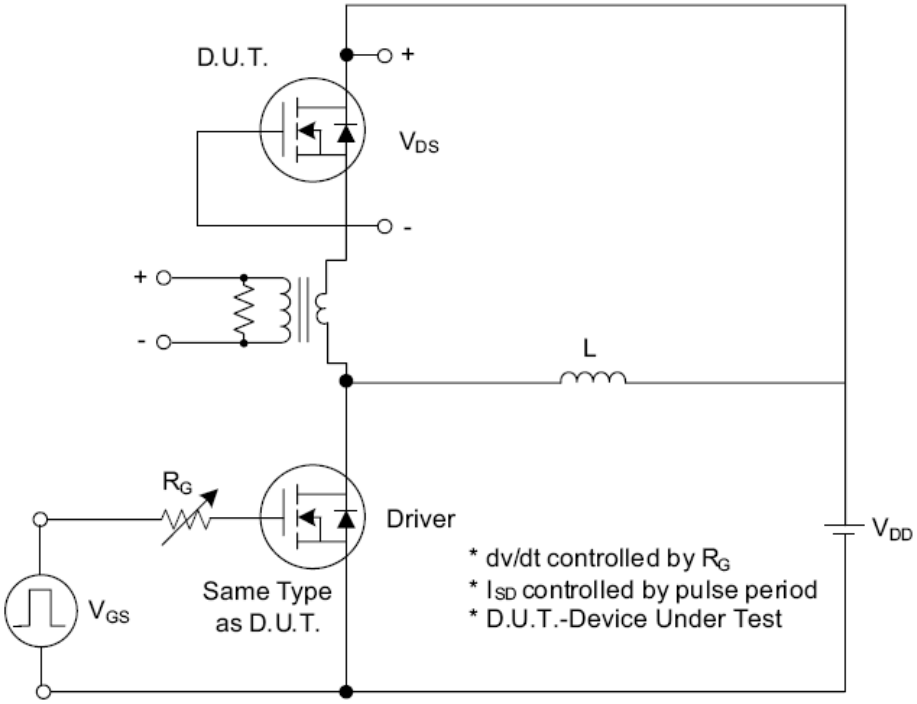


Fig. 1.1 Peak Diode Recovery dv/dt Test Circuit

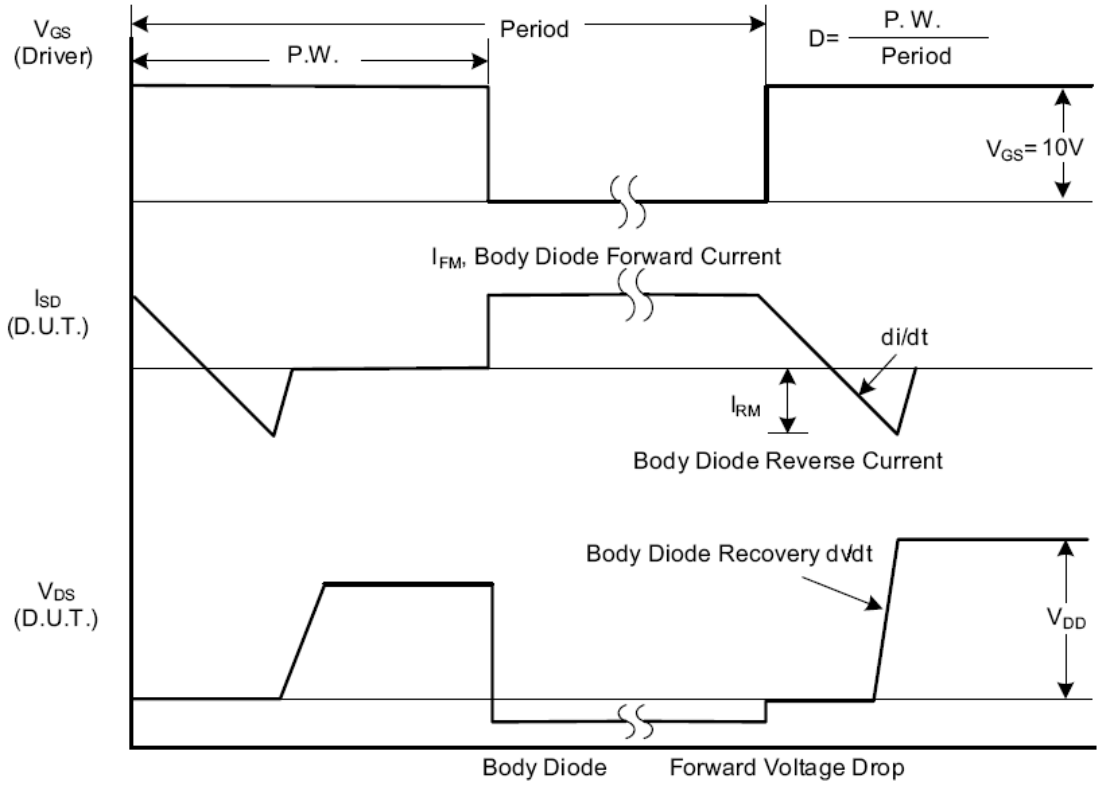


Fig. 1.2 Peak Diode Recovery dv/dt Waveforms

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Test Circuits and Waveforms (Cont.)

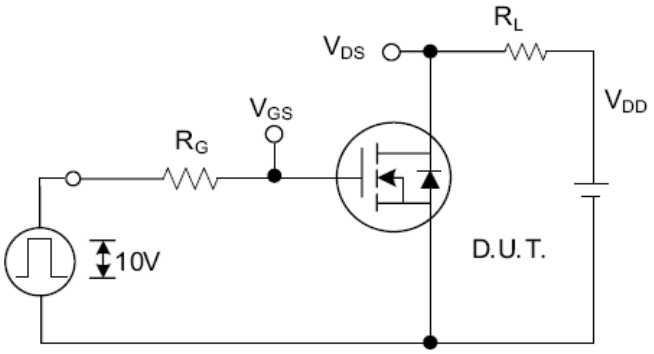


Fig. 2.1 Switching Test Circuit

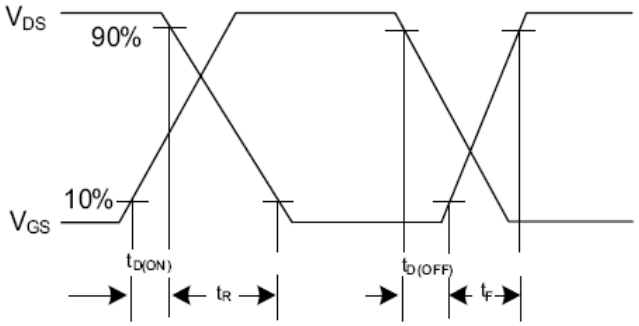


Fig. 2.2 Switching Waveforms

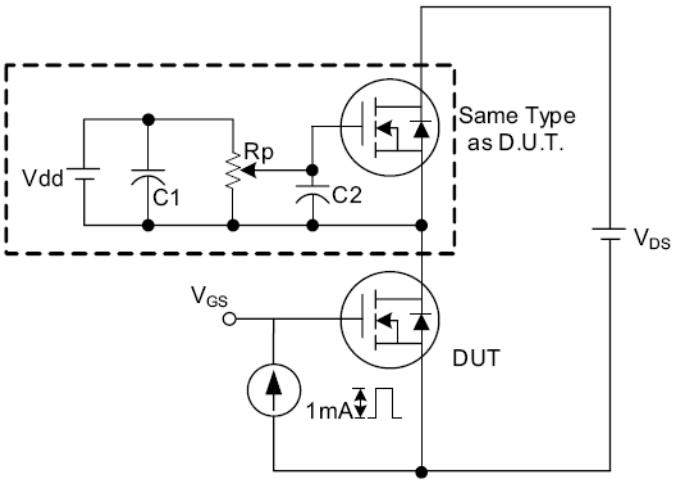


Fig. 3 . 1 Gate Charge Test Circuit

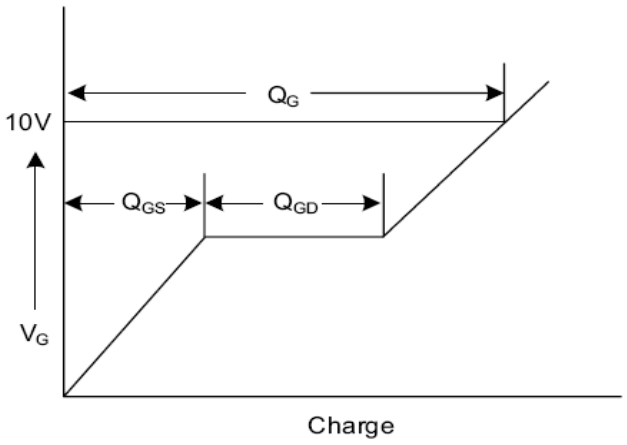


Fig. 3 . 2 Gate Charge Waveform

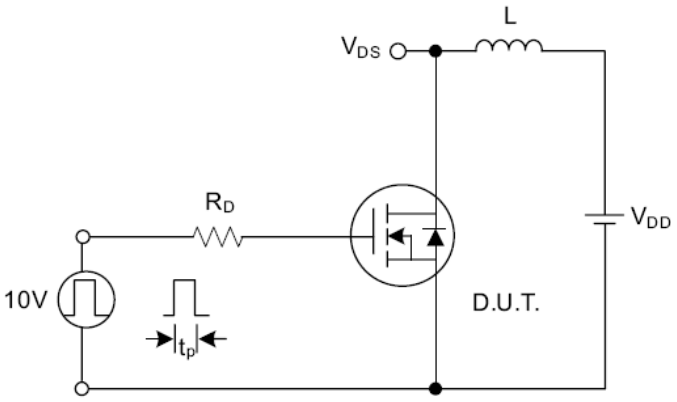


Fig. 4.1 Unclamped Inductive Switching Test Circuit

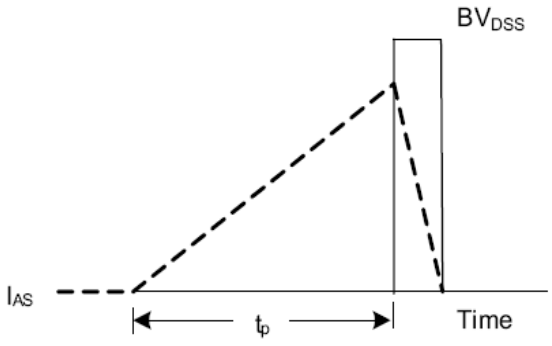


Fig. 4.2 Unclamped Inductive Switching Waveforms

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   b. support or sustain life,
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