



## 600V N-ch Multi-Epi Super-Junction MOSFET

**Pb** Lead Free Package and Finish

### General Features

- Multi-Epi Process
- Proprietary New Super-Junction Technology
- $R_{DS(ON),typ.}=0.11\Omega@V_{GS}=10V$
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

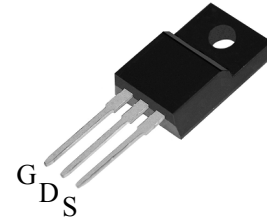
$BV_{DSS@T_{JMAX}}$	$R_{DS(ON),typ.}$	$I_D$
650V	0.11Ω	25A

### Applications

- Adaptor
- Charger
- SMPS Standby Power

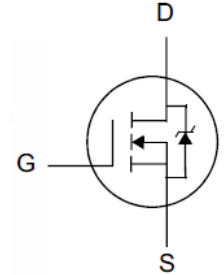
### Ordering Information

Part Number	Package	Brand
SPTA60R130E	TO-220F	



TO-220F

Package No to Scale



### Absolute Maximum Ratings

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

Symbol	Parameter	Value	Unit
		SPTA60R130E	
$V_{DSS}$	Drain-to-Source Voltage	600	V
$V_{GSS}$	Gate source voltage (static)	±20	
	Gate source voltage (dynamic) AC (f>1Hz)	±30	
$I_D$	Continuous Drain Current @ $T_C = 25^\circ\text{C}$	25	A
	Continuous Drain Current @ $T_C = 100^\circ\text{C}$	15	
$I_{DM}$	Pulsed Drain Current at $V_{GS}=10V^{[1]}$	75	
dv/dt	Reverse diode dv/dt	15	V/ns
$d_{IF}/dt$	Maximum diode commutation speed	50	A/us
$E_{AS}$	Single Pulse Avalanche Energy <sup>[2]</sup>	898	mJ
$P_D$	Power Dissipation	35	W
$T_J$ & $T_{STG}$	Operating and Storage Temperature Range	-55 to 150	°C

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
		SPTA60R130E	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	3.57	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	100	



## Electrical Characteristics

### OFF Characteristics

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	600	--	--	V	$V_{GS}=0V, I_D=250\mu A$
$I_{DSS}$	Drain-to-Source Leakage Current	--	--	1	$\mu A$	$V_{DS}=600V, V_{GS}=0V$
$I_{GSS}$	Gate-to-Source Leakage Current	--	--	+100	nA	$V_{GS}=+30V, V_{DS}=0V$
		--	--	-100		$V_{GS}=-30V, V_{DS}=0V$

### ON Characteristics

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance <sup>[3]</sup>	--	0.11	0.15	$\Omega$	$V_{GS}=10V, I_D=10.0A$
$V_{GS(TH)}$	Gate Threshold Voltage	2.5	--	4.5	V	$V_{DS}=V_{GS}, I_D=250\mu A$
gfs	Forward Transconductance <sup>[3]</sup>	--	10.5	--	S	$V_{DS}=10V, I_D=5.0A$

### Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$C_{iss}$	Input Capacitance	--	1966	--	pF	$V_{GS}=0V,$ $V_{DS}=50V,$ $f=10KHz$
$C_{oss}$	Output Capacitance	--	208	--		
$R_G$	Gate resistance (Intrinsic)	--	5.8	--	$\Omega$	$f = 1.0MHz$ Open Drain
$Q_g$	Total Gate Charge	--	48	--	nC	$V_{DD}=400V,$ $I_D=11.3A, V_{GS}=0$ to 13V
$Q_{gs}$	Gate-to-Source Charge	--	8.5	--		
$Q_{gd}$	Gate-to-Drain (Miller) Charge	--	8.5	--		
$V_{plateau}$	Gate plateau voltage	--	6.3	--	V	

### Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	38	--	pF	$V_{DD}=400V,$ $I_D=11.3A,$ $V_{GS}=10V$ $R_g=1.7\Omega$
$t_{rise}$	Rise Time	--	28	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	67	--		
$t_{fall}$	Fall Time	--	21	--		

**Source-Drain Body Diode Characteristics**T<sub>J</sub>=25°C unless otherwise specified

Symbol	Parameter	Min	Typ.	Max.	Unit	Test Conditions
I <sub>SD</sub>	Continuous Source Current <sup>[2]</sup>	--	--	25	A	Maximum Ratings
I <sub>SM</sub>	Pulsed Source Current <sup>[2]</sup>	--	--	75		
V <sub>SD</sub>	Diode Forward Voltage	--	--	1.2	V	I <sub>S</sub> =3.8A, V <sub>GS</sub> =0V
t <sub>rr</sub>	Reverse Recovery Time	--	293	--	ns	V <sub>R</sub> =400V, V <sub>GS</sub> =0V I <sub>F</sub> =3.2A, di/dt =100A/μs
Q <sub>rr</sub>	Reverse Recovery Charge	--	3.9	--	uC	
I <sub>rrm</sub>	PeakReverseRecoveryCurrent	--	26.7	--	A	

**Note:**

[1] Repetitive Rating: Pulse width limited by maximum junction temperature

[2] L = 10mH, VDD= 80V, Starting T<sub>J</sub>= 25°C

[3] Pulse Test: Pulse width ≤ 380us, Duty Cycle ≤ 2%

## Test Circuits and Waveforms

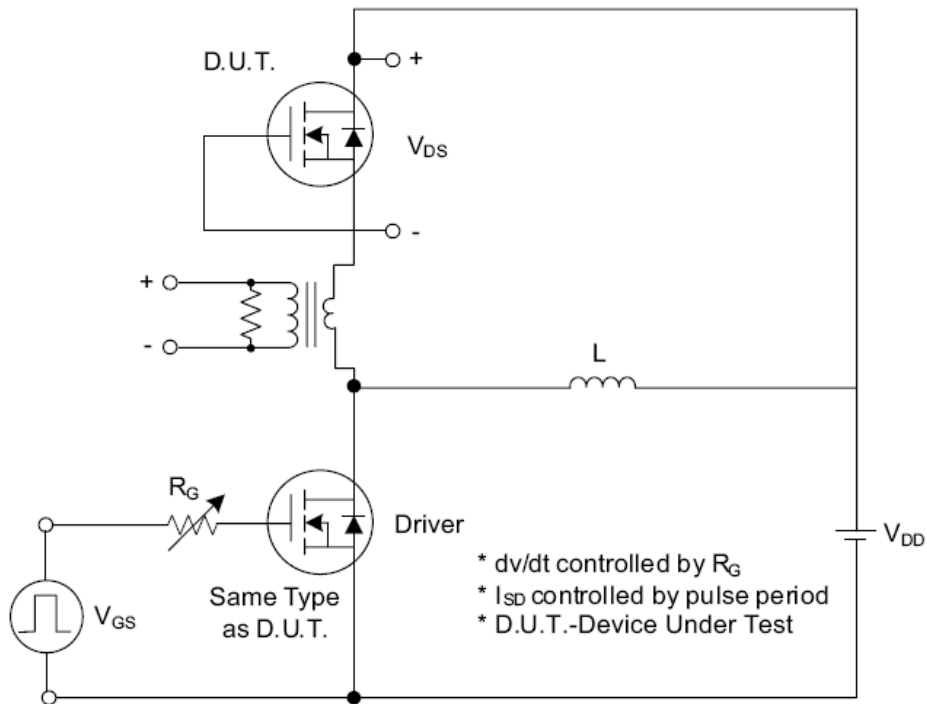


Fig. 1.1 Peak Diode Recovery  $dv/dt$  Test Circuit

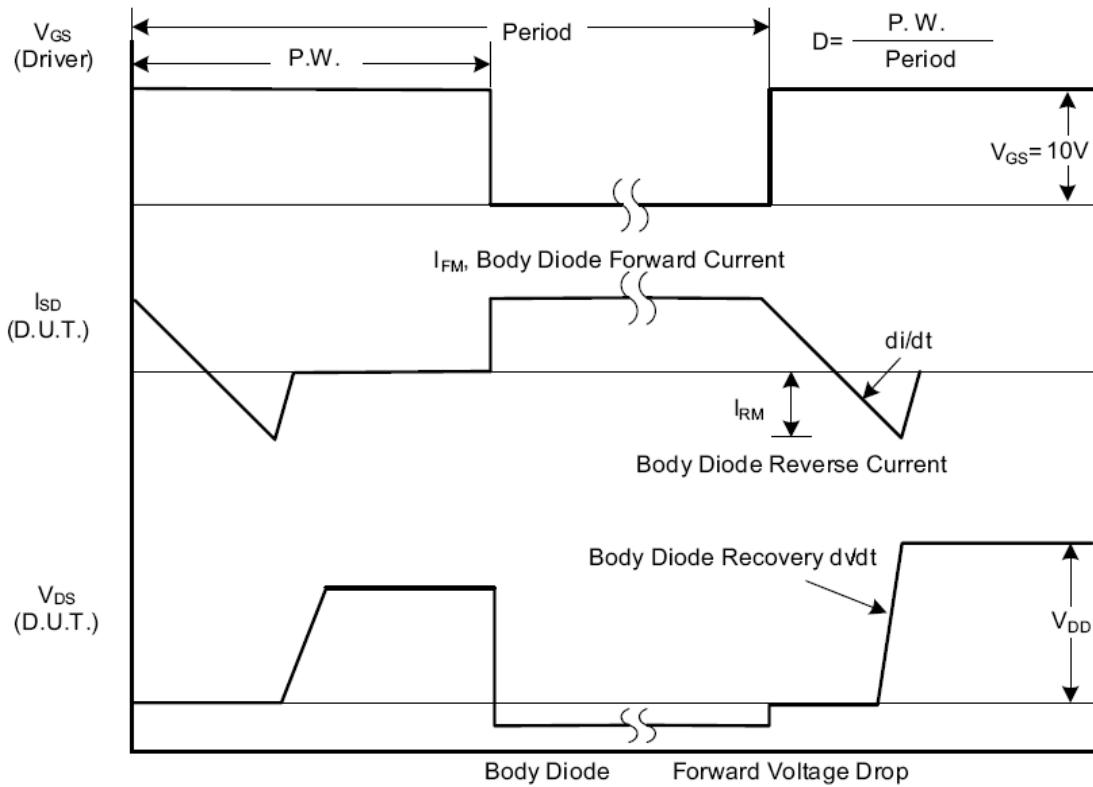


Fig. 1.2 Peak Diode Recovery  $dv/dt$  Waveforms

Test Circuits and Waveforms (Cont.)

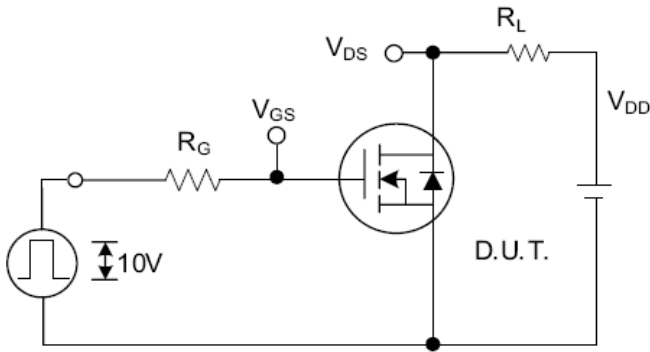


Fig. 2.1 Switching Test Circuit

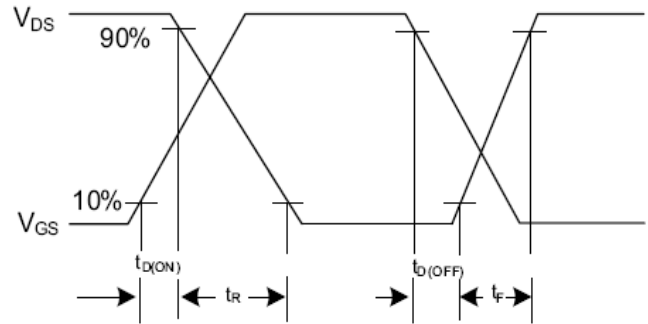


Fig. 2.2 Switching Waveforms

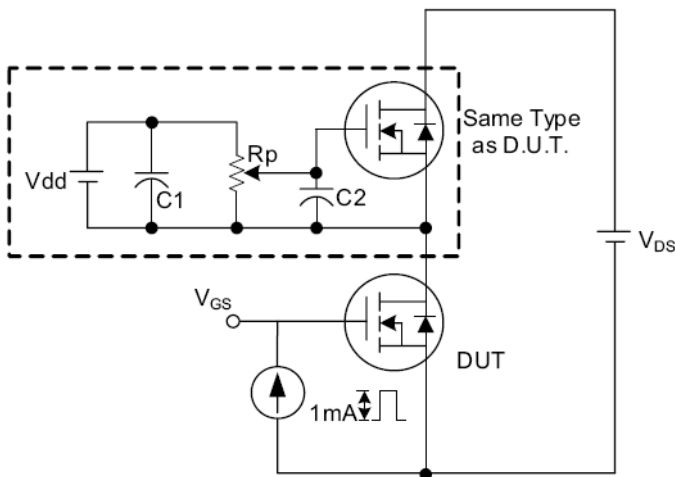


Fig. 3.1 Gate Charge Test Circuit

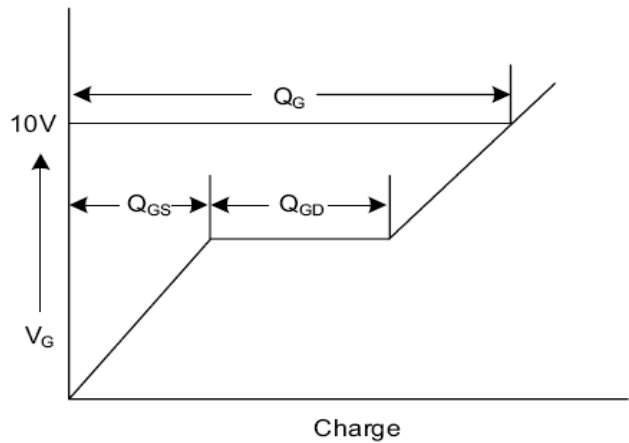


Fig. 3.2 Gate Charge Waveform

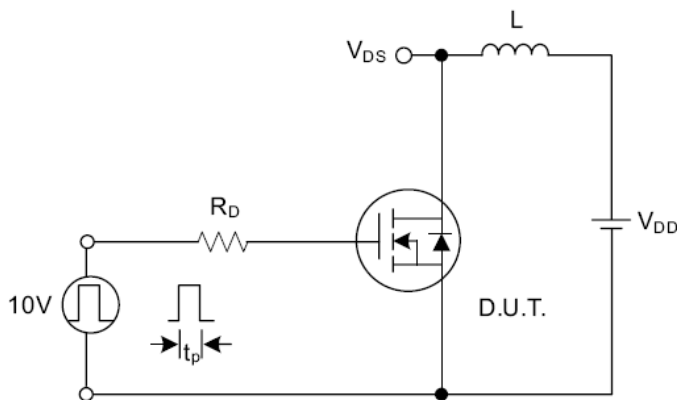


Fig. 4.1 Unclamped Inductive Switching Test Circuit

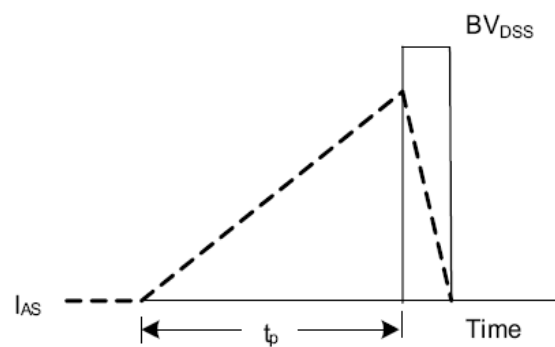


Fig. 4.2 Unclamped Inductive Switching Waveforms



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