

**Applications**

- Zero Voltage Switching SMPS
- Telecom and Server Power Supplies
- Uninterruptible Power Supplies
- Motor Control applications

V <sub>DSS</sub>	R <sub>DS(on)</sub> typ.	T <sub>rr</sub> typ.	I <sub>D</sub>
500V	0.125Ω	170ns	34A

**Features and Benefits**

- SuperFast body diode eliminates the need for external diodes in ZVS applications.
- Lower Gate charge results in simpler drive requirements.
- Enhanced dv/dt capabilities offer improved ruggedness.
- Higher Gate voltage threshold offers improved noise immunity.



**Absolute Maximum Ratings**

	Parameter	Max.	Units
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	34	A
I <sub>D</sub> @ T <sub>C</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	22	
I <sub>DM</sub>	Pulsed Drain Current ①	140	
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Power Dissipation	450	W
	Linear Derating Factor	3.6	W/°C
V <sub>GS</sub>	Gate-to-Source Voltage	±30	V
dv/dt	Peak Diode Recovery dv/dt ③	15	V/ns
T <sub>J</sub>	Operating Junction and	-55 to +150	°C
T <sub>STG</sub>	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw	1.1(10)	

**Diode Characteristics**

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	34	A	MOSFET symbol showing the integral reverse p-n junction diode.
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①	—	—	140		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.5	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 34A, V <sub>GS</sub> = 0V ④
t <sub>rr</sub>	Reverse Recovery Time	—	170	250	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 34A
		—	220	330		T <sub>J</sub> = 125°C, di/dt = 100A/μs ④
Q <sub>rr</sub>	Reverse Recovery Charge	—	670	1010	nC	T <sub>J</sub> = 25°C, I <sub>S</sub> = 34A, V <sub>GS</sub> = 0V ④
		—	1500	2200		T <sub>J</sub> = 125°C, di/dt = 100A/μs ④
I <sub>RRM</sub>	Reverse Recovery Current	—	8.5	—	A	T <sub>J</sub> = 25°C
t <sub>on</sub>	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

# IRFPS35N50L

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## Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	500	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.12	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	0.125	0.145	$\Omega$	$V_{GS} = 10V, I_D = 20A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	50	$\mu A$	$V_{DS} = 500V, V_{GS} = 0V$
		—	—	2.0	mA	$V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 30V$
	Gate-to-Source Reverse Leakage	—	—	-100	nA	$V_{GS} = -30V$
$R_G$	Internal Gate Resistance	—	1.1	—	$\Omega$	$f = 1MHz, \text{open drain}$

## Dynamic @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$g_{fs}$	Forward Transconductance	18	—	—	S	$V_{DS} = 50V, I_D = 20A$
$Q_g$	Total Gate Charge	—	—	230	nC	$I_D = 34A$
$Q_{gs}$	Gate-to-Source Charge	—	—	65		$V_{DS} = 400V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	110		$V_{GS} = 10V, \text{See Fig. 7 \& 15}$ ④
$t_{d(on)}$	Turn-On Delay Time	—	24	—	ns	$V_{DD} = 250V$
$t_r$	Rise Time	—	100	—		$I_D = 34A$
$t_{d(off)}$	Turn-Off Delay Time	—	42	—		$R_G = 1.2\Omega$
$t_f$	Fall Time	—	42	—		$V_{GS} = 10V, \text{See Fig. 10a \& 10b}$ ④
$C_{iss}$	Input Capacitance	—	5580	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	590	—		$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	58	—		$f = 1.0MHz, \text{See Fig. 5}$
$C_{oss}$	Output Capacitance	—	7290	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$
$C_{oss}$	Output Capacitance	—	160	—		$V_{GS} = 0V, V_{DS} = 400V, f = 1.0MHz$
$C_{oss \text{ eff.}}$	Effective Output Capacitance	—	320	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 400V$ ⑤
$C_{oss \text{ eff. (ER)}}$	Effective Output Capacitance (Energy Related)	—	220	—		

## Avalanche Characteristics

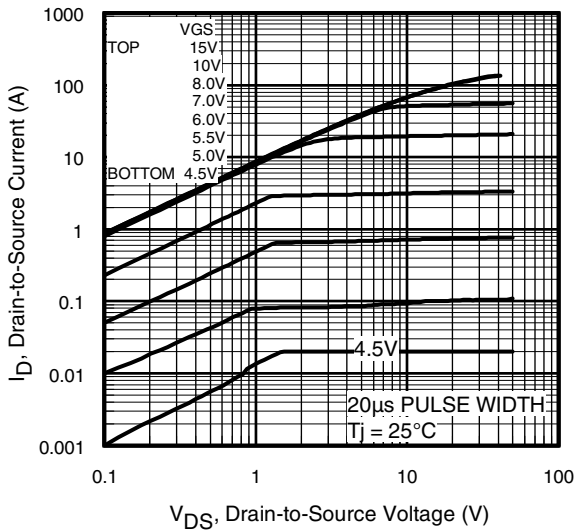
Symbol	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ⑥	—	560	mJ
$I_{AR}$	Avalanche Current ①	—	34	A
$E_{AR}$	Repetitive Avalanche Energy ①	—	45	mJ

## Thermal Resistance

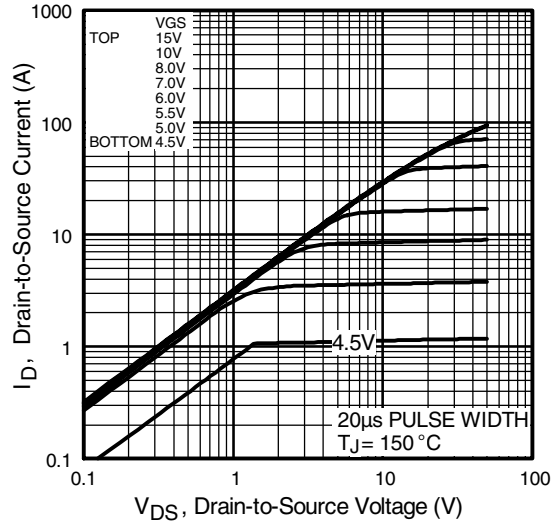
Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑥	—	0.28	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient ⑥	—	40	

### Notes:

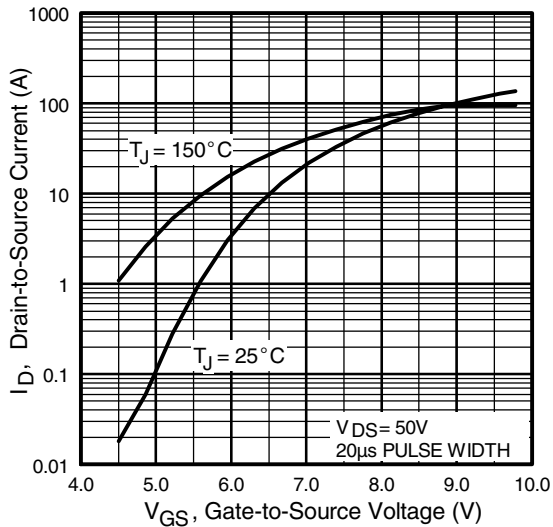
- ① Repetitive rating; pulse width limited by max. junction temperature. (See Fig. 11)
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.97mH$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 34A$  (See Figure 13)
- ③  $I_{SD} \leq 34A$ ,  $di/dt \leq 765A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 150^\circ\text{C}$ .
- ④ Pulse width  $\leq 400\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤  $C_{oss \text{ eff.}}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .  
 $C_{oss \text{ eff. (ER)}}$  is a fixed capacitance that stores the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .
- ⑥  $R_{\theta}$  is measured at  $T_J$  approximately  $90^\circ\text{C}$



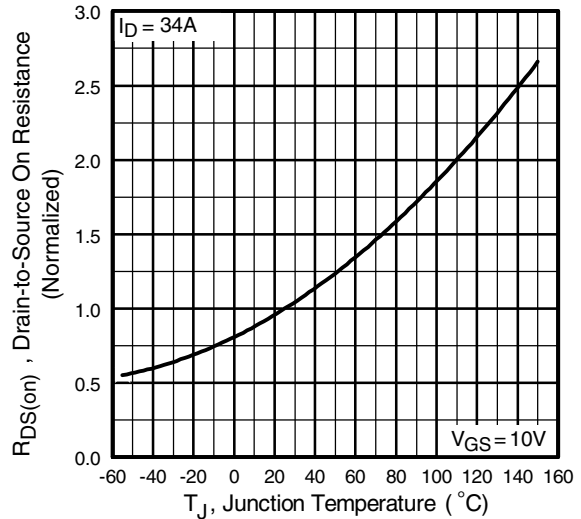
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics

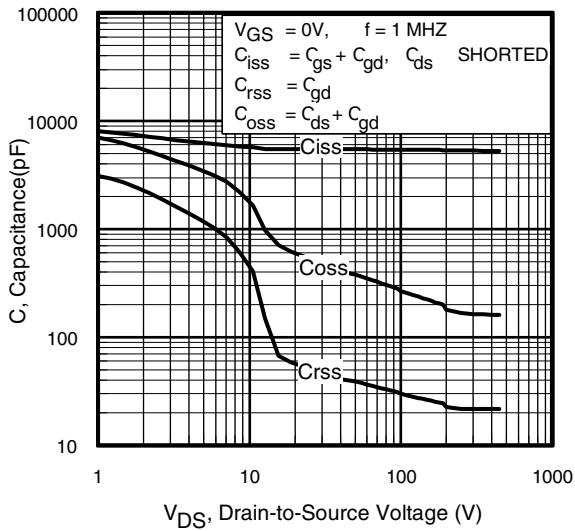


**Fig 3.** Typical Transfer Characteristics

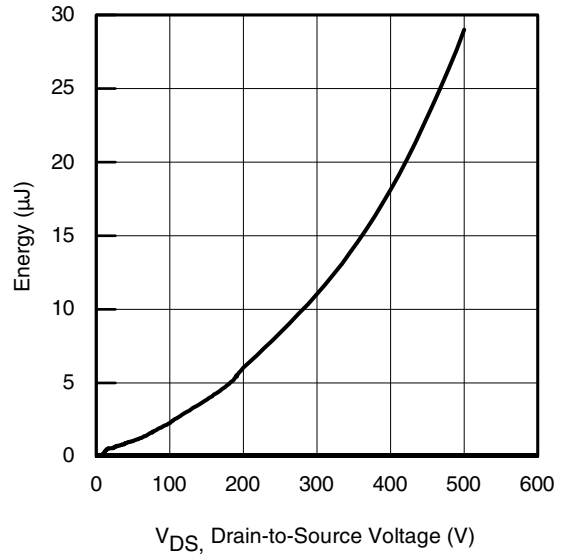


**Fig 4.** Normalized On-Resistance Vs. Temperature

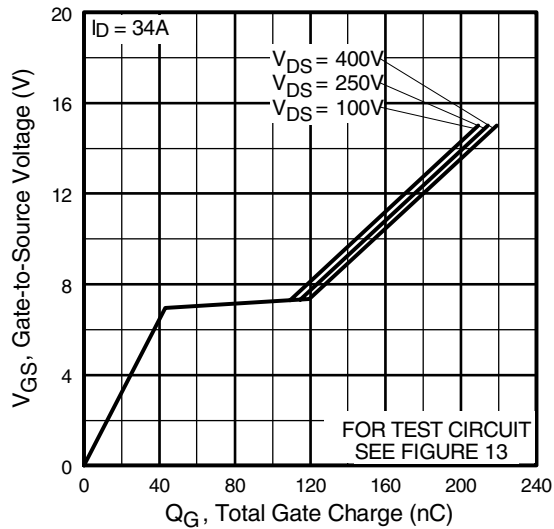
# IRFPS35N50L



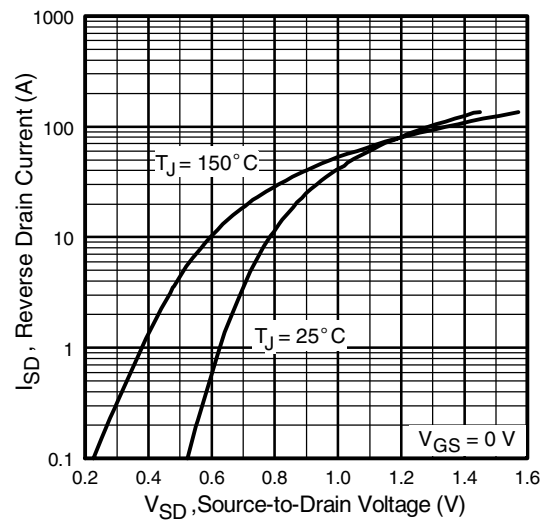
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



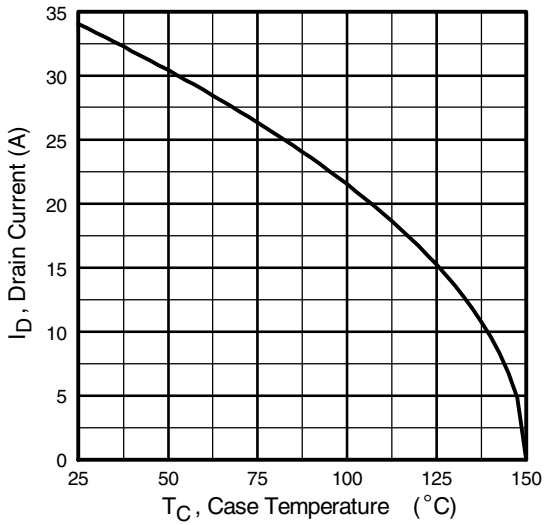
**Fig 6.** Typ. Output Capacitance Stored Energy vs.  $V_{DS}$



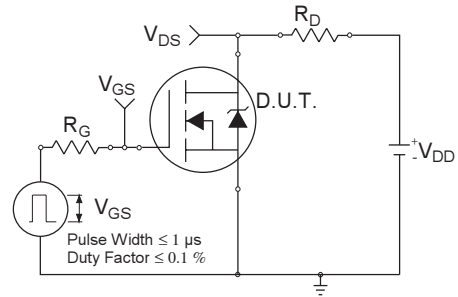
**Fig 7.** Typical Gate Charge Vs. Gate-to-Source Voltage



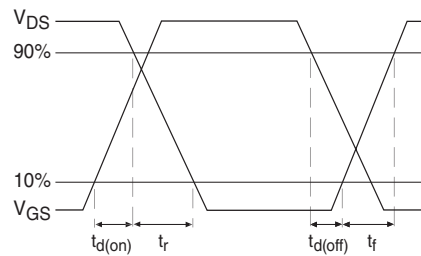
**Fig 8.** Typical Source-Drain Diode Forward Voltage



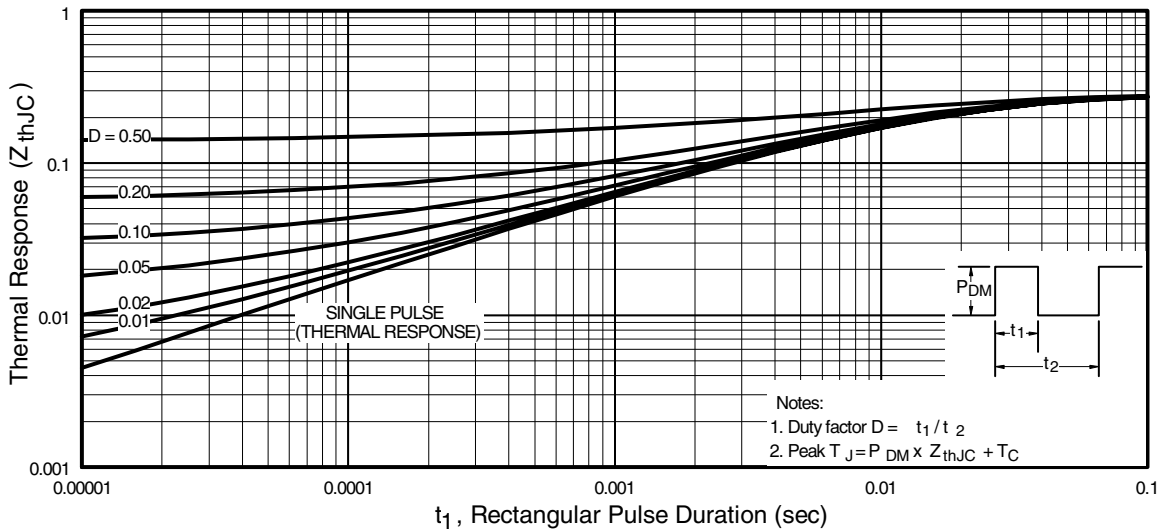
**Fig 9.** Maximum Drain Current Vs. Case Temperature



**Fig 10a.** Switching Time Test Circuit



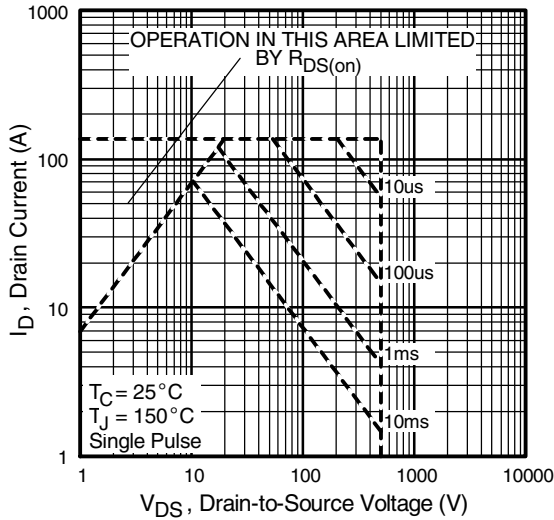
**Fig 10b.** Switching Time Waveforms



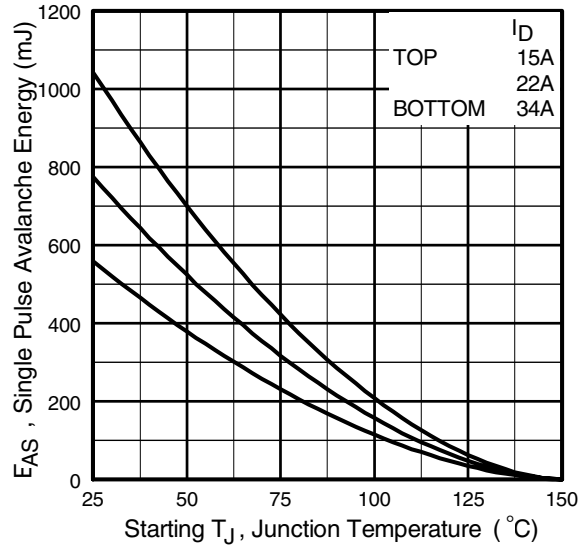
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

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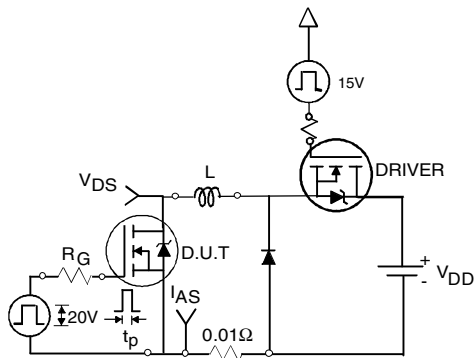
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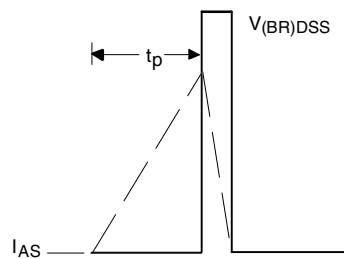
**Fig 12.** Maximum Safe Operating Area



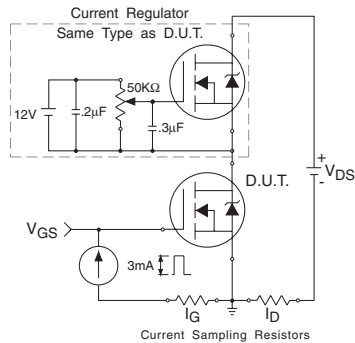
**Fig 13.** Maximum Avalanche Energy Vs. Drain Current



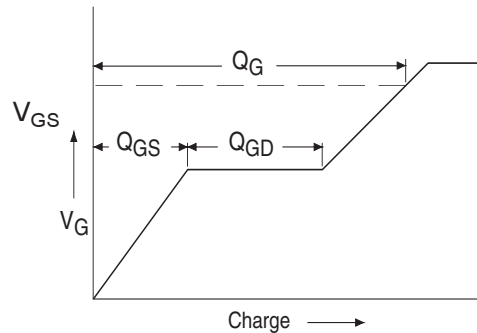
**Fig 14a.** Unclamped Inductive Test Circuit



**Fig 14b.** Unclamped Inductive Waveforms

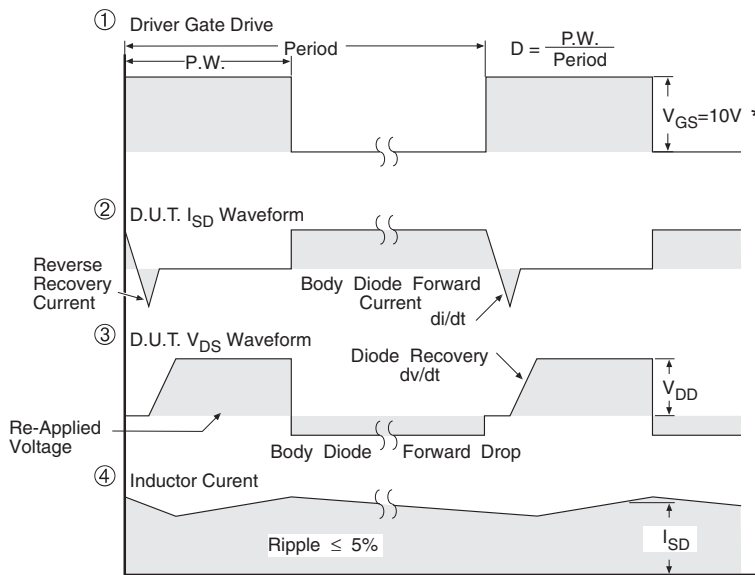
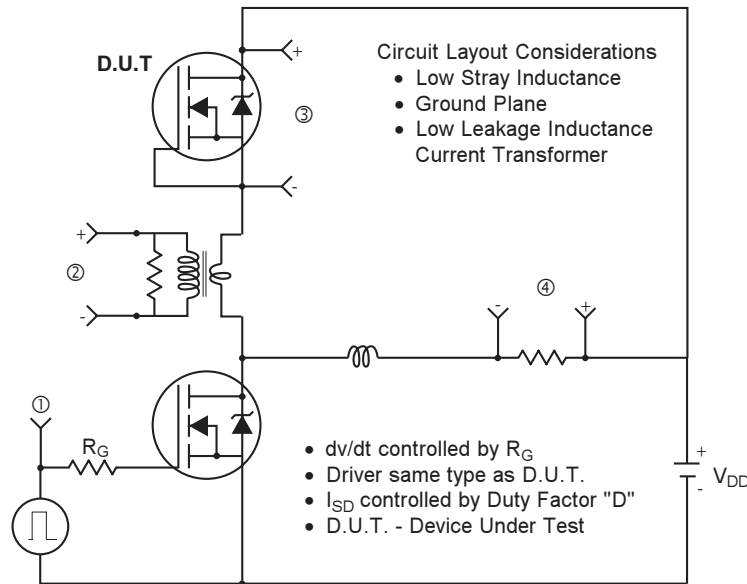


**Fig 15a.** Gate Charge Test Circuit



**Fig 15b.** Basic Gate Charge Waveform

## Peak Diode Recovery dv/dt Test Circuit



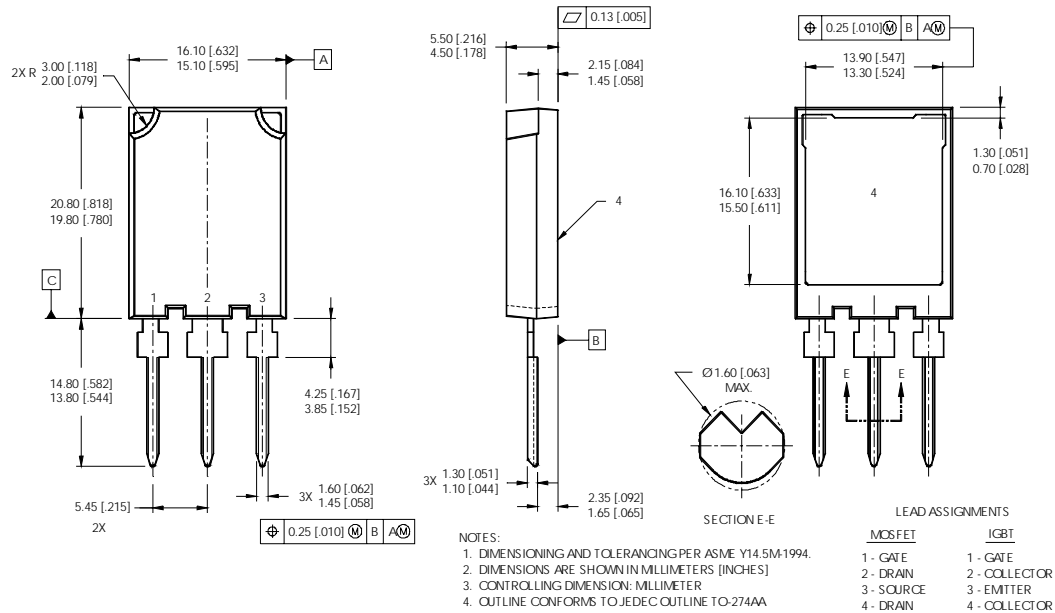
\*  $V_{GS} = 5V$  for Logic Level Devices

**Fig 14.** For N-Channel HEXFET® Power MOSFETs

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## Super-247™ (TO-274AA) Package Outline

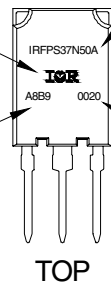


## Super-247™ (TO-274AA) Part Marking Information

EXAMPLE: THIS IS AN IRFPS37N50A WITH  
ASSEMBLY LOT CODE A8B9

INTERNATIONAL RECTIFIER  
LOGO

ASSEMBLY LOT CODE



PART NUMBER

DATE CODE  
(YYWW)  
YY = YEAR  
WW = WEEK

TOP

**Super TO-247™ package is not recommended for Surface Mount Application.**

Data and specifications subject to change without notice.  
This product has been designed and qualified for the Industrial market.  
Qualification Standards can be found on IR's Web site.

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**IR** Rectifier

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TAC Fax: (310) 252-7903

08/04





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