International
IOR Rectifier

SMPS MOSFET

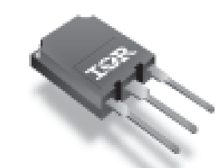
PD - 94384A

IRFPS40N60K

HEXFET® Power MOSFET

Applications
- Hard Switching Primary or PFC Switch
- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- Motor Drive

V_{DSS}	$R_{DS(on)}$ typ.	I_D
600V	0.110 Ω	40A



SUPER TO-247AC

Benefits
- Low Gate Charge Qg results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Enhanced Body Diode dv/dt Capability

Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	40	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	24	
I_{DM}	Pulsed Drain Current ①	160	
P_D @T_C = 25°C	Power Dissipation	570	W
	Linear Derating Factor	4.5	W/°C
V_{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ③	7.5	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	

Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	—	600	mJ
I_{AR}	Avalanche Current①	—	40	A
E_{AR}	Repetitive Avalanche Energy①	—	57	mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case⑥	—	0.22	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient⑥	—	40	

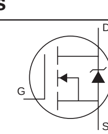
Static @ T_J = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	600	–––	–––	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	–––	0.63	–––	V/°C	Reference to 25°C, I_D = 1mA ⑥
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	–––	0.110	0.130	Ω	V_{GS} = 10V, I_D = 24A ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	–––	5.0	V	V_{DS} = V_{GS}, I_D = 250µA
I_{DSS}	Drain-to-Source Leakage Current	–––	–––	50	µA	V_{DS} = 600V, V_{GS} = 0V
		–––	–––	250		V_{DS} = 480V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage	–––	–––	100	nA	V_{GS} = 30V
	Gate-to-Source Reverse Leakage	–––	–––	-100		V_{GS} = -30V

Dynamic @ T_J = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	21	–––	–––	S	V_{DS} = 50V, I_D = 24A
Q_g	Total Gate Charge	–––	–––	330	nC	I_D = 38A
Q_{gs}	Gate-to-Source Charge	–––	–––	84		V_{DS} = 480V
Q_{gd}	Gate-to-Drain ("Miller") Charge	–––	–––	150		V_{GS} = 10V, See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	–––	47	–––	ns	V_{DD} = 300V
t_r	Rise Time	–––	110	–––		I_D = 38A
$t_{d(off)}$	Turn-Off Delay Time	–––	97	–––		R_G = 4.3Ω
t_f	Fall Time	–––	60	–––		V_{GS} = 10V,See Fig. 10 ④
C_{iss}	Input Capacitance	–––	7970	–––	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	–––	750	–––		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	–––	75	–––		f = 1.0MHz, See Fig. 5
C_{oss}	Output Capacitance	–––	9440	–––		V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz
C_{oss}	Output Capacitance	–––	200	–––		V_{GS} = 0V, V_{DS} = 480V, f = 1.0MHz
C_{oss} eff.	Effective Output Capacitance	–––	260	–––		V_{GS} = 0V, V_{DS} = 0V to 480V ⑤

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	–––	–––	40	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	–––	–––	160		
V_{SD}	Diode Forward Voltage	–––	–––	1.5	V	T_J = 25°C, I_S = 38A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	–––	630	950	ns	T_J = 25°C, I_F = 38A
		–––	730	1090		T_J = 125°C, di/dt = 100A/µs ④
Q_{rr}	Reverse Recovery Charge	–––	14	20	µC	T_J = 25°C
		–––	17	25		T_J = 125°C
I_{RRM}	Reverse Recovery Current	–––	39	58	A	T_J = 25°C
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

① Repetitive rating; pulse width limited by max. junction temperature.(See Fig. 11)

② Starting T_J = 25°C, L = 0.84mH, R_G = 25Ω, I_{AS} = 38A, (See Figure 12a)

③ $I_{SD} \leq$ 38A, di/dt $\leq$ 224A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 150°C

④ Pulse width ≤ 300µs; duty cycle ≤ 2%.

⑤ C_{oss} 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}

⑥ R_θ is measured at T_J approximately 90°C

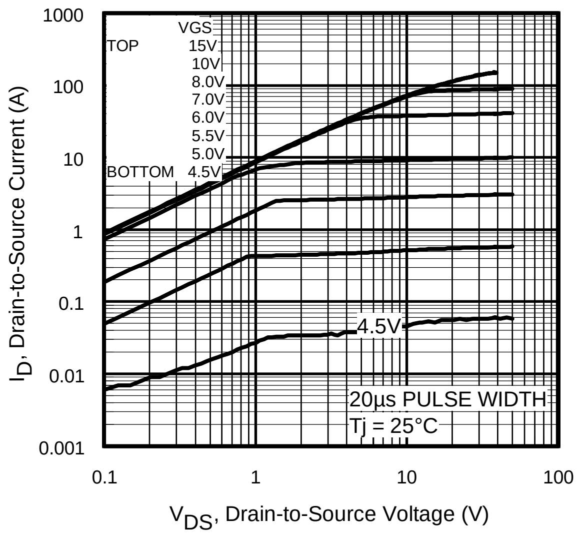


Fig 1. Typical Output Characteristics

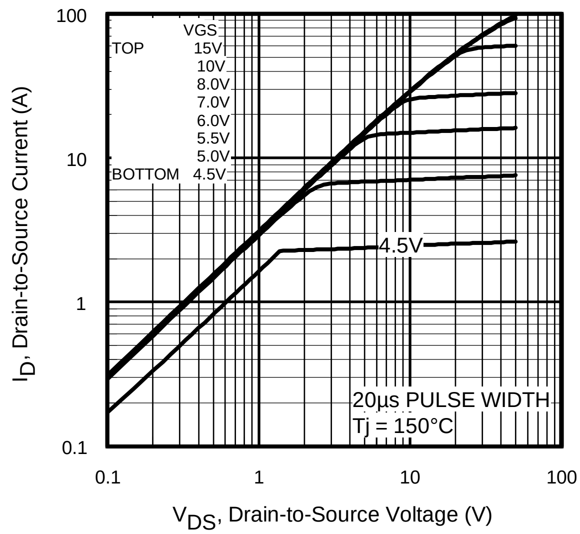


Fig 2. Typical Output Characteristics

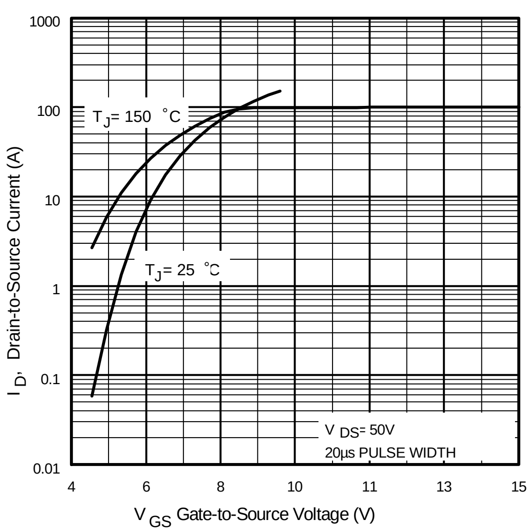


Fig 3. Typical Transfer Characteristics

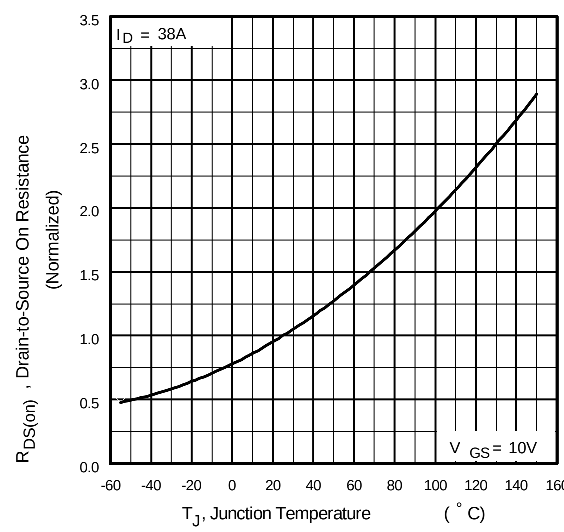


Fig 4. Normalized On-Resistance Vs. Temperature

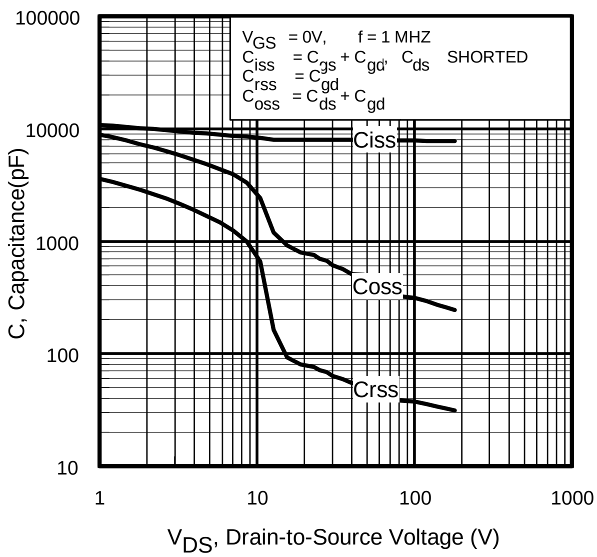


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

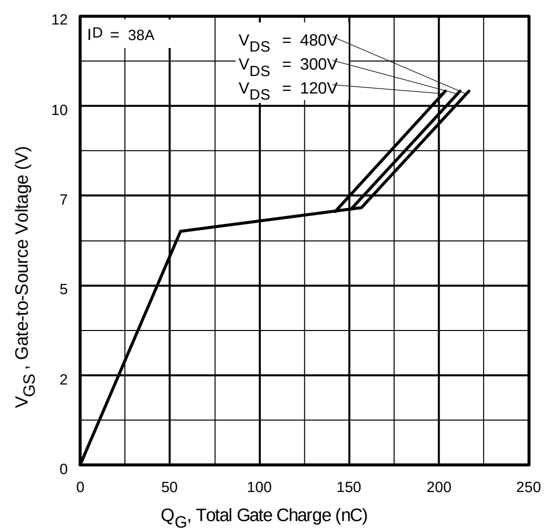


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

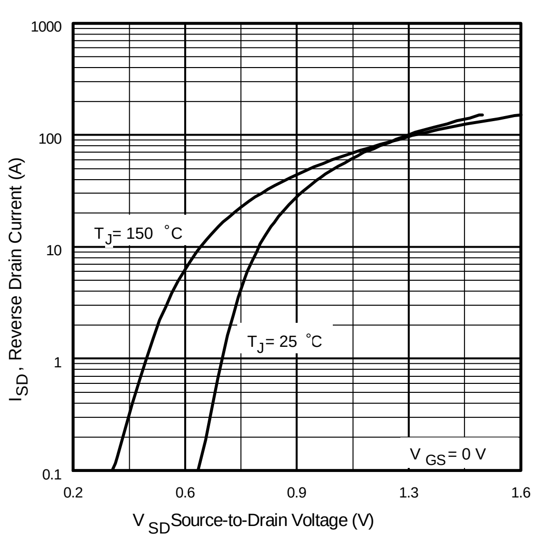


Fig 7. Typical Source-Drain Diode Forward Voltage

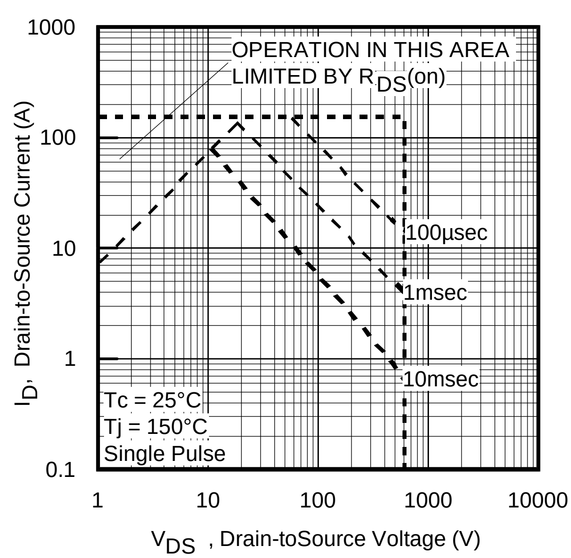


Fig 8. Maximum Safe Operating Area

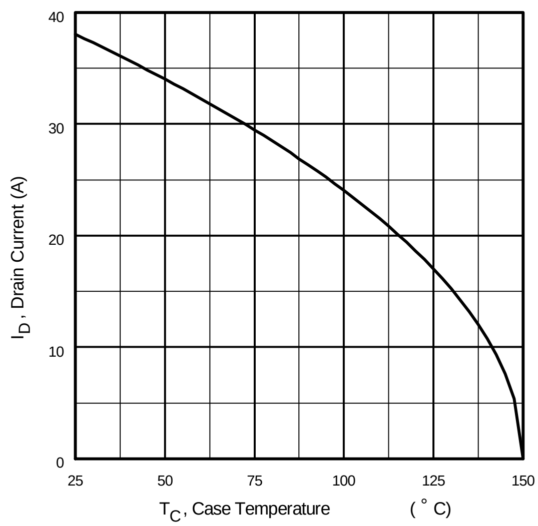


Fig 9. Maximum Drain Current Vs. Case Temperature

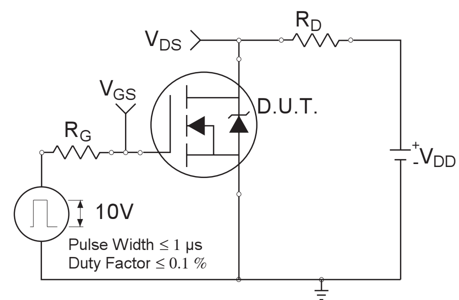


Fig 10a. Switching Time Test Circuit

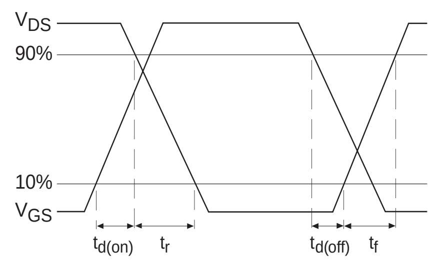


Fig 10b. Switching Time Waveforms

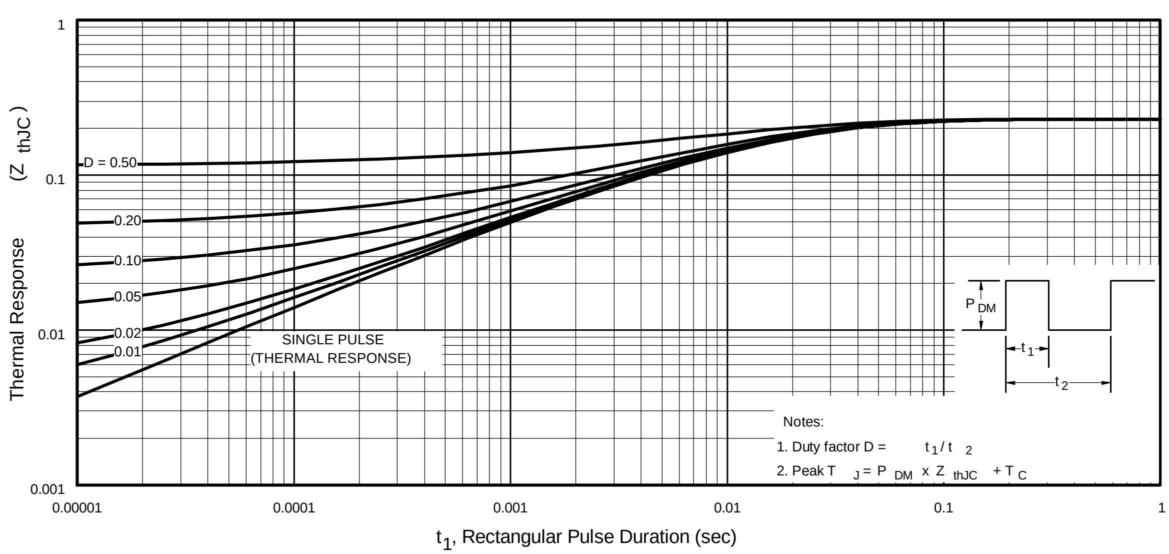


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

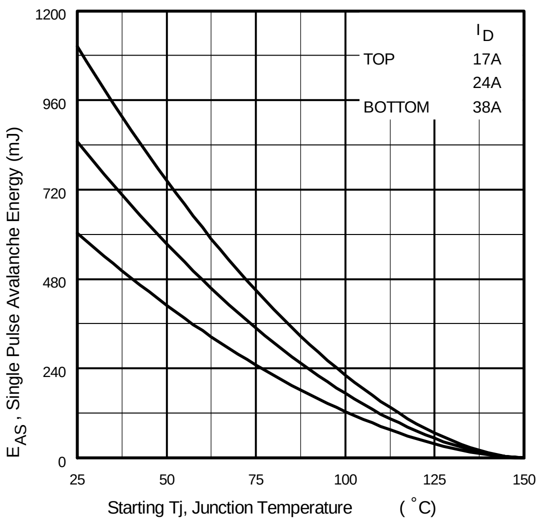


Fig 12a. Maximum Avalanche Energy Vs. Drain Current

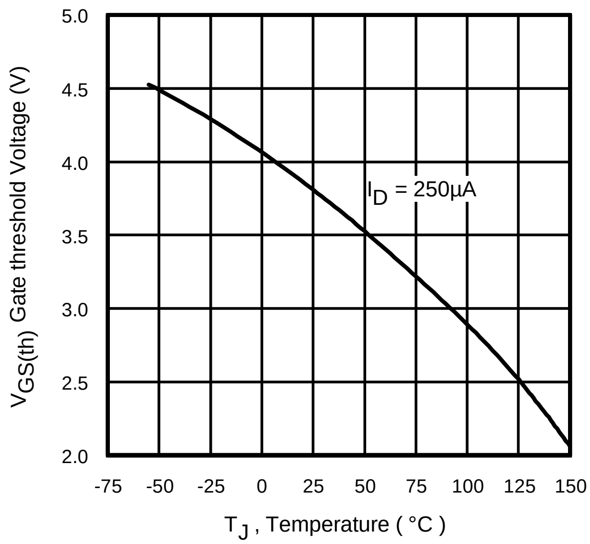


Fig 14. Threshold Voltage Vs. Temperature

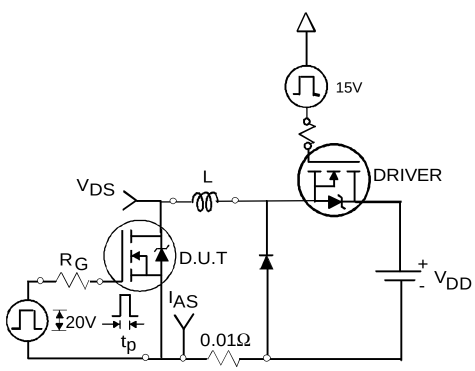


Fig 12b. Unclamped Inductive Test Circuit

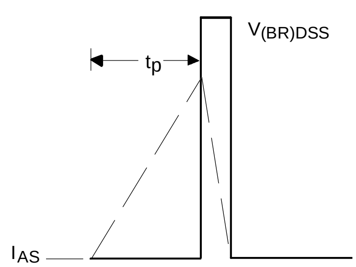


Fig 12c. Unclamped Inductive Waveforms

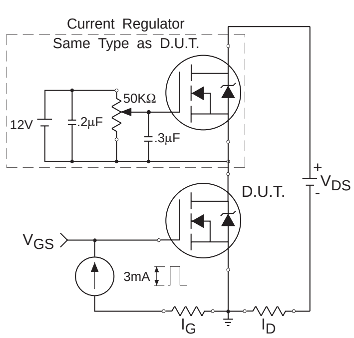


Fig 13a. Gate Charge Test Circuit

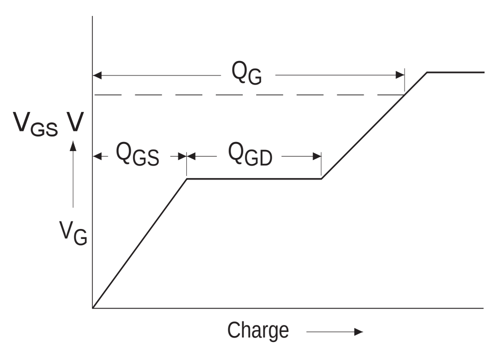
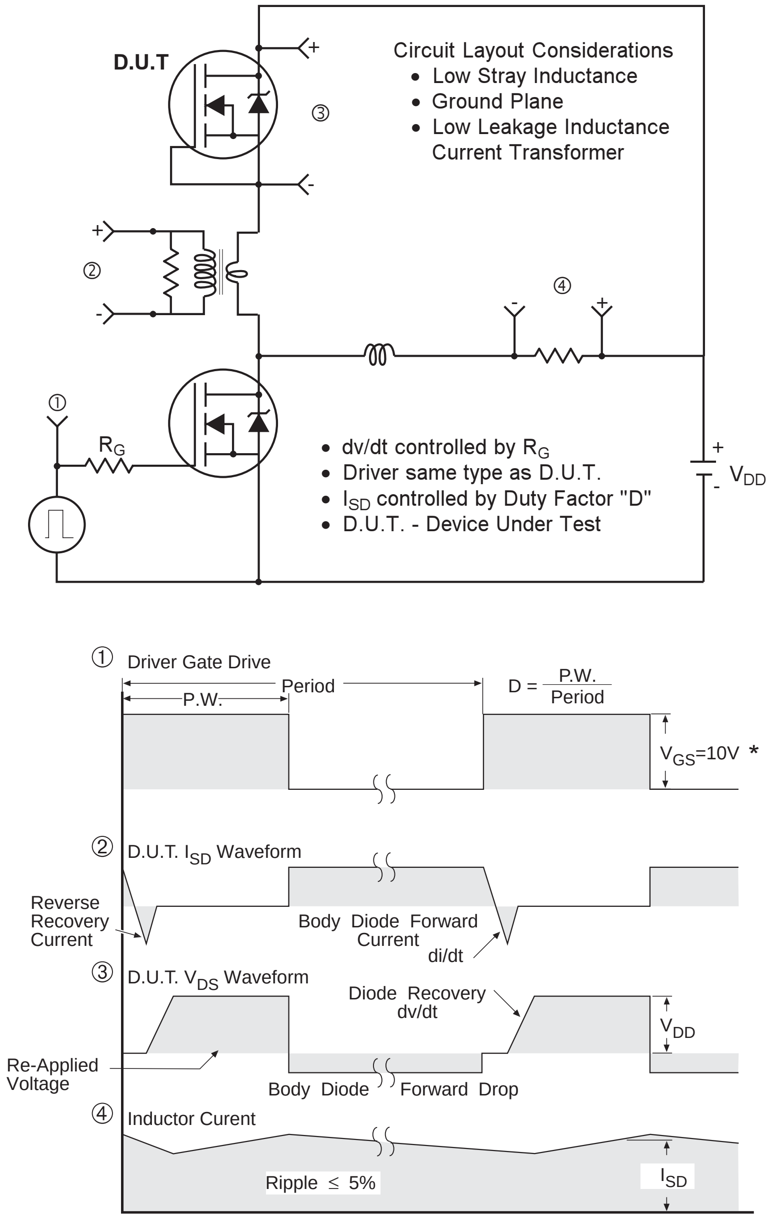


Fig 13b. Basic Gate Charge Waveform

Peak Diode Recovery dv/dt Test Circuit

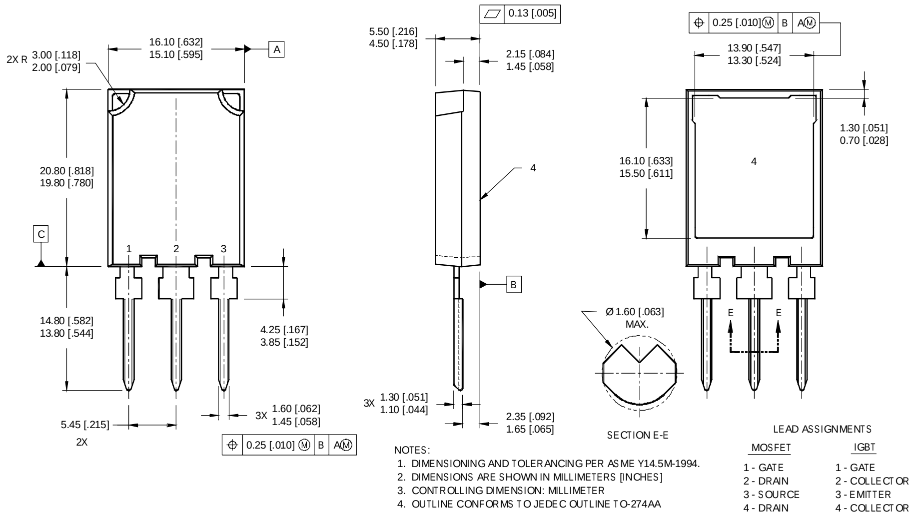


* V_{GS} = 5V for Logic Level Devices

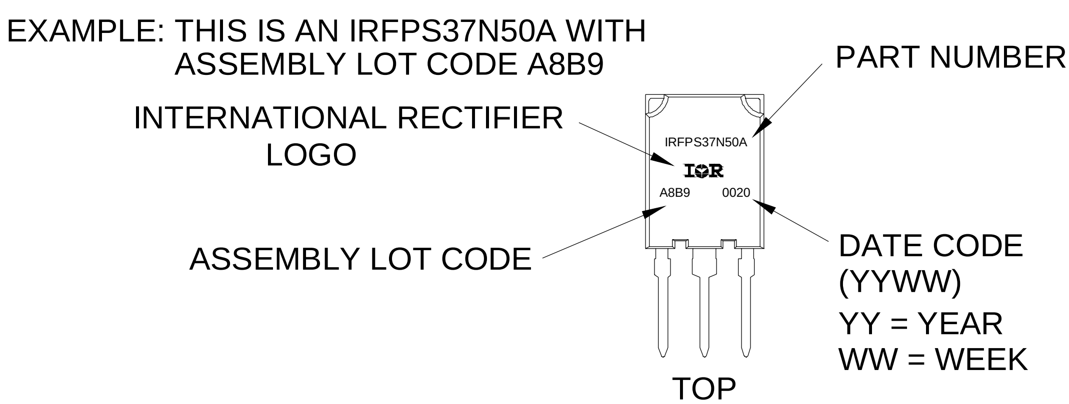
Fig 14. For N-Channel HEXFET® Power MOSFETs

SUPER TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



Super-247™ Part Marking Information



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.

International IOR Rectifier

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