

SMPS MOSFET IRFPS38N60L

Applications

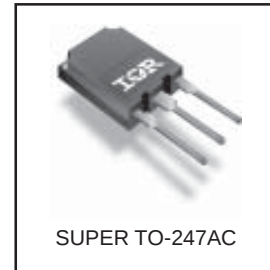
- Zero Voltage Switching SMPS
- Telecom and Server Power Supplies
- Uninterruptible Power Supplies
- Motor Control applications

HEXFET® Power MOSFET

V_{DS}	$R_{DS(on)}$ typ.	T_{rr} typ.	I_D
600V	120m Ω	170ns	38A

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_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	38	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	24	
I_{DM}	Pulsed Drain Current ①	150	
P_D @ $T_C = 25^\circ\text{C}$	Power Dissipation	540	W
	Linear Derating Factor	4.3	W/ $^\circ\text{C}$
V_{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ②	13	V/ns
T_J	Operating Junction and	-55 to + 150	$^\circ\text{C}$
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw	1.1(10)	N•m (lbf•in)

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	38	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	150		
V_{SD}	Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}$, $I_S = 38\text{A}$, $V_{GS} = 0\text{V}$ ④
t_{rr}	Reverse Recovery Time	—	170	250	ns	$T_J = 25^\circ\text{C}$, $I_F = 38\text{A}$
		—	420	630		$T_J = 125^\circ\text{C}$, $di/dt = 100\text{A}/\mu\text{s}$ ④
Q_{rr}	Reverse Recovery Charge	—	830	1240	nC	$T_J = 25^\circ\text{C}$, $I_S = 38\text{A}$, $V_{GS} = 0\text{V}$ ④
		—	2600	3900		$T_J = 125^\circ\text{C}$, $di/dt = 100\text{A}/\mu\text{s}$ ④
I_{RRM}	Reverse Recovery Current	—	9.1	14	A	$T_J = 25^\circ\text{C}$
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

IRFPS38N60L

International
IR Rectifier

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	600	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.41	—	V/°C	Reference to 25°C , $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	120	150	m Ω	$V_{GS} = 10V, I_D = 23A$ 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	μA	$V_{DS} = 600V, V_{GS} = 0V$
		—	—	2.0	mA	$V_{DS} = 480V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
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	—	1.2	—	Ω	$f = 1MHz$, open drain

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	20	—	—	S	$V_{DS} = 50V, I_D = 23A$
Q_g	Total Gate Charge	—	—	320	nC	$I_D = 38A$
Q_{gs}	Gate-to-Source Charge	—	—	85	nC	$V_{DS} = 480V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	160	nC	$V_{GS} = 10V$, See Fig. 7 & 15 ④
$t_{d(on)}$	Turn-On Delay Time	—	44	—	ns	$V_{DD} = 300V$
t_r	Rise Time	—	130	—	ns	$I_D = 38A$
$t_{d(off)}$	Turn-Off Delay Time	—	92	—	ns	$R_G = 4.3\Omega$
t_f	Fall Time	—	69	—	ns	$V_{GS} = 10V$, See Fig. 11a & 11b ④
C_{iss}	Input Capacitance	—	7990	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	740	—	pF	$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	72	—	pF	$f = 1.0MHz$, See Fig. 5
$C_{oss \text{ eff.}}$	Effective Output Capacitance	—	350	—	pF	$V_{GS} = 0V, V_{DS} = 0V$ to $480V$ ⑤
$C_{oss \text{ eff. (ER)}}$	Effective Output Capacitance (Energy Related)	—	260	—	pF	

Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy ②	—	680	mJ
I_{AR}	Avalanche Current ①	—	38	A
E_{AR}	Repetitive Avalanche Energy ①	—	54	mJ

Thermal Resistance

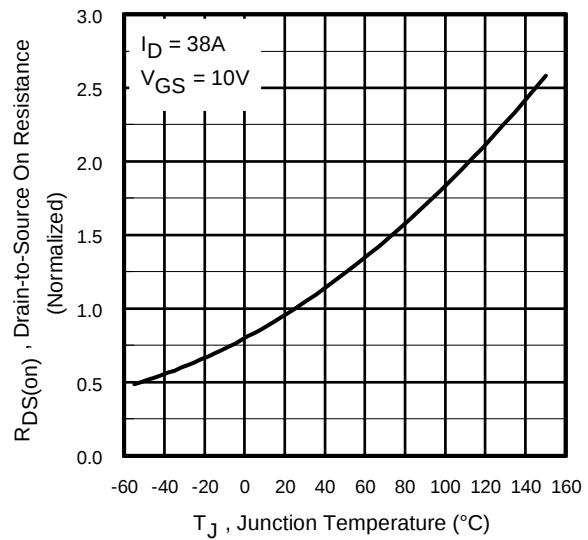
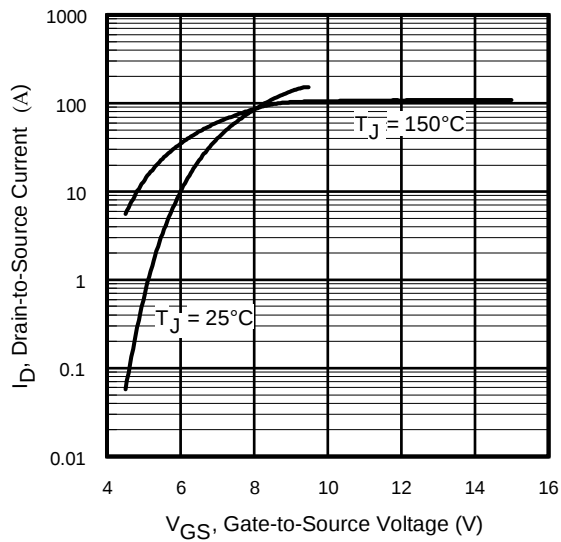
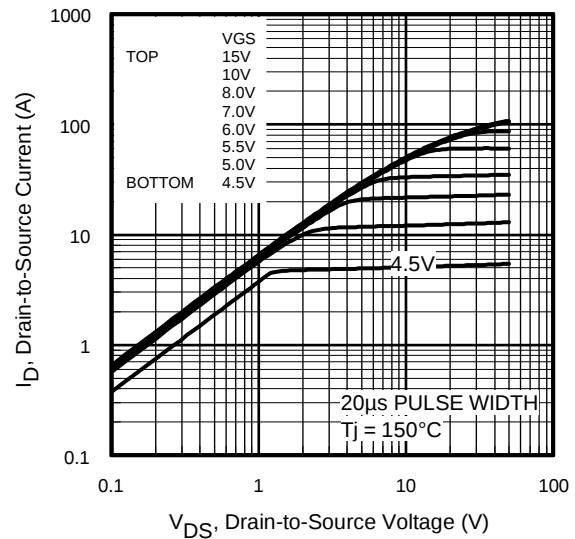
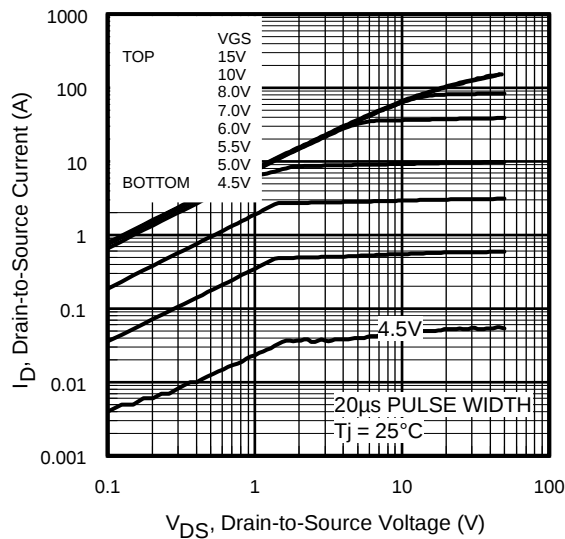
Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.22	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient	—	40	

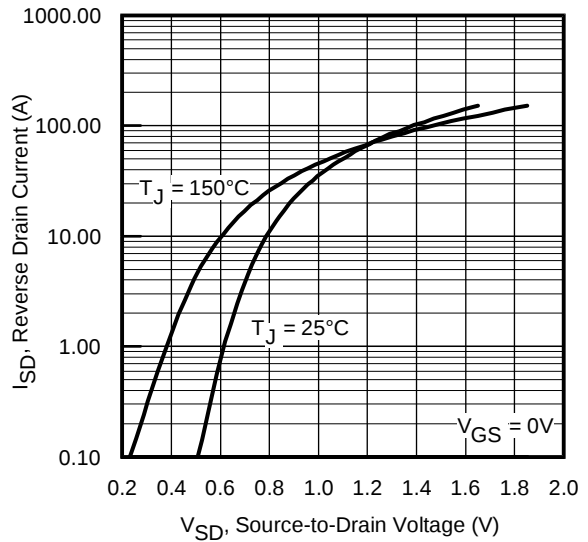
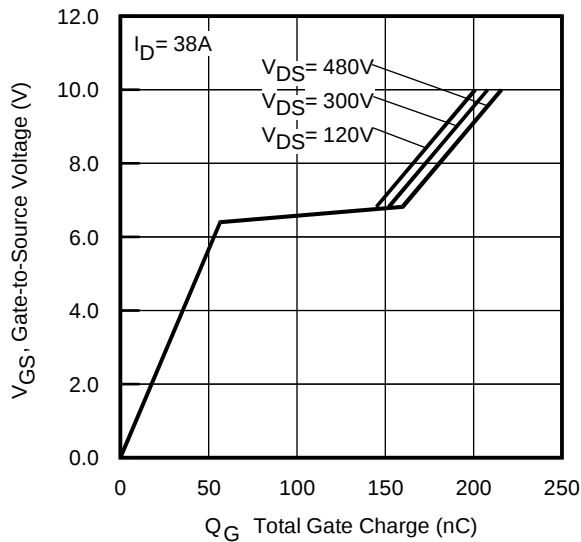
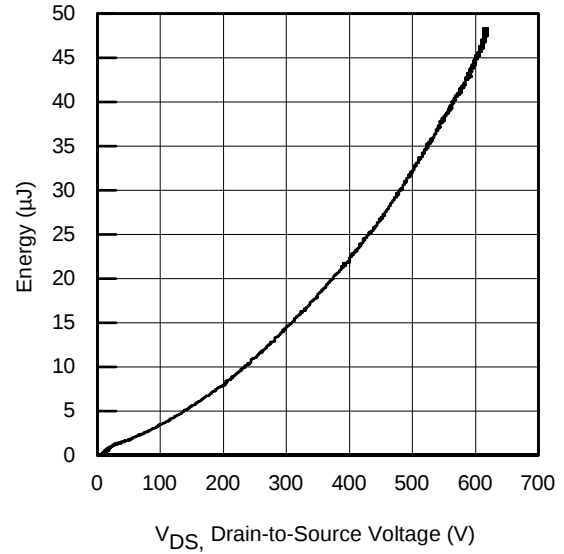
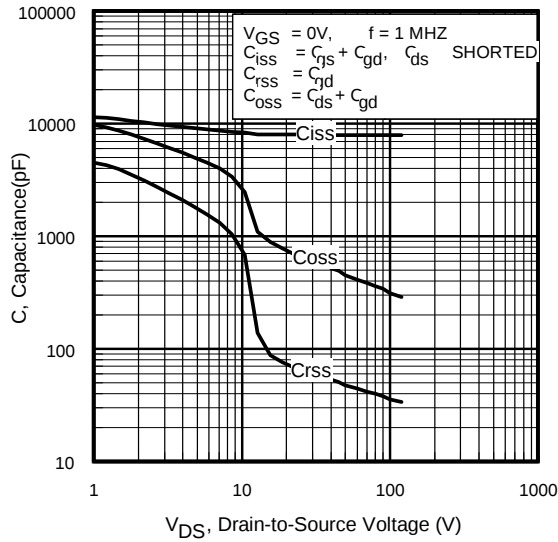
Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See Fig. 11)
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.91mH$, $R_G = 25\Omega$, $I_{AS} = 38A$, $dv/dt = 13V/ns$. (See Figure 12a)
- ③ $I_{SD} \leq 38A$, $di/dt \leq 630A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150^\circ\text{C}$.

④ Pulse width $\leq 300\mu s$; 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 $80\% V_{DSS}$.





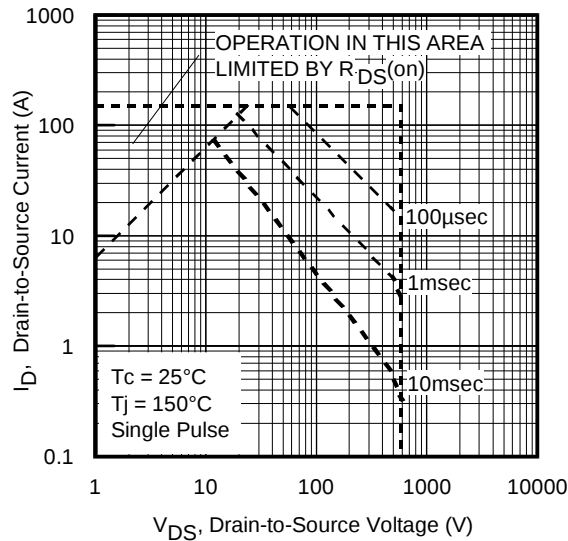


Fig 9. Maximum Safe Operating Area

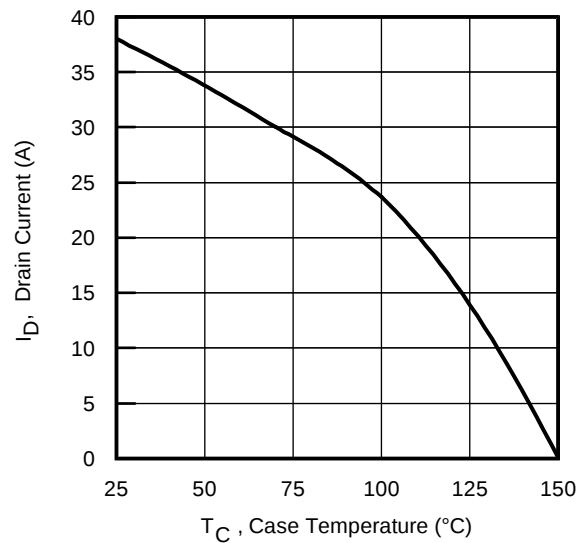


Fig 10. Maximum Drain Current vs. Case Temperature

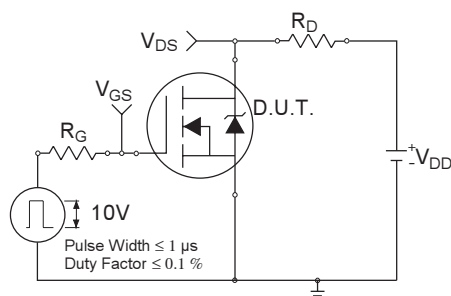


Fig 11a. Switching Time Test Circuit

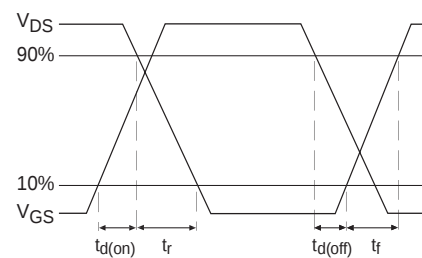


Fig 11b. Switching Time Waveforms

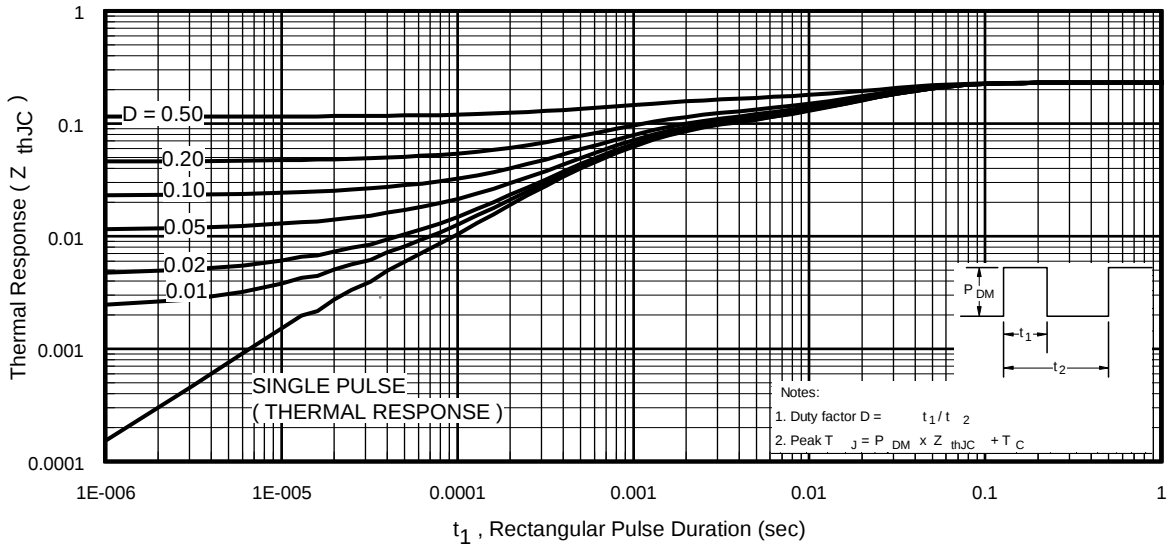


Fig 12. Maximum Effective Transient Thermal Impedance, Junction-to-Case

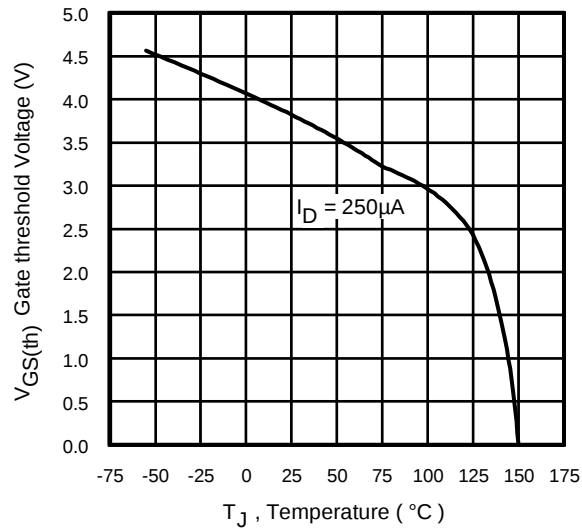


Fig 13. Threshold Voltage vs. Temperature

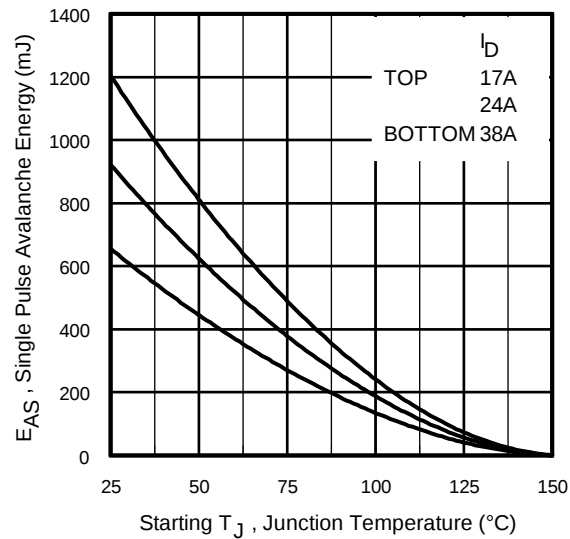


Fig 14a. Maximum Avalanche Energy vs. Drain Current

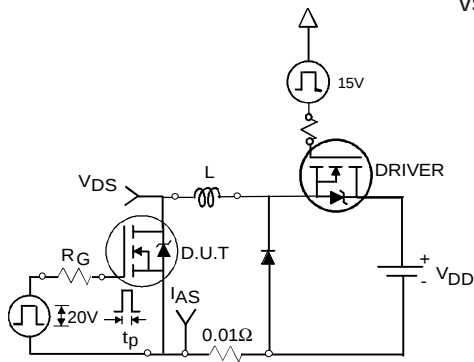


Fig 14b. Unclamped Inductive Test Circuit

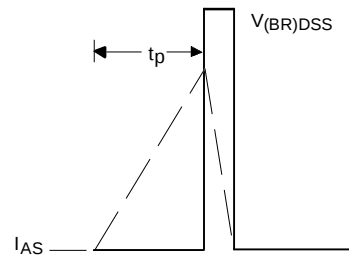


Fig 14c. Unclamped Inductive Waveforms

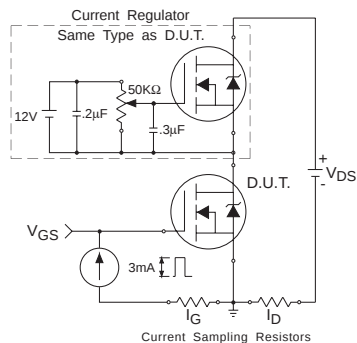


Fig 15a. Gate Charge Test Circuit

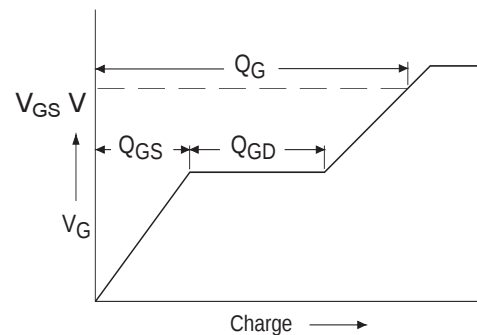
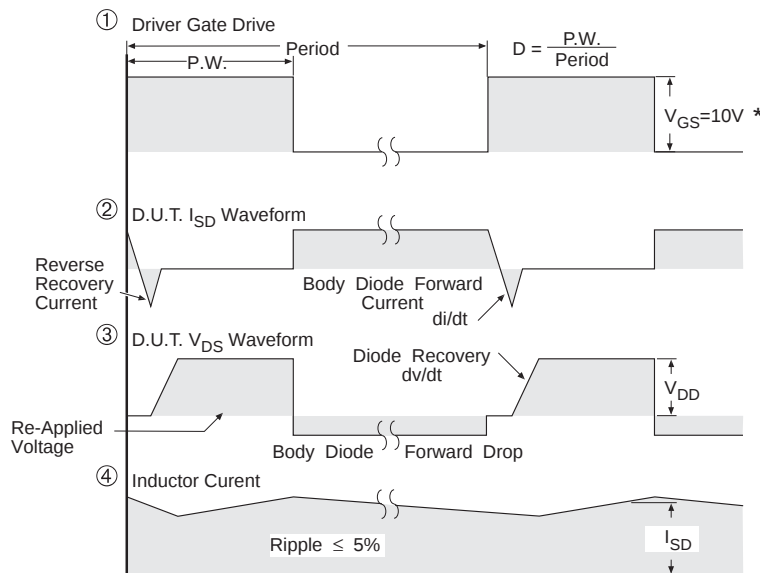
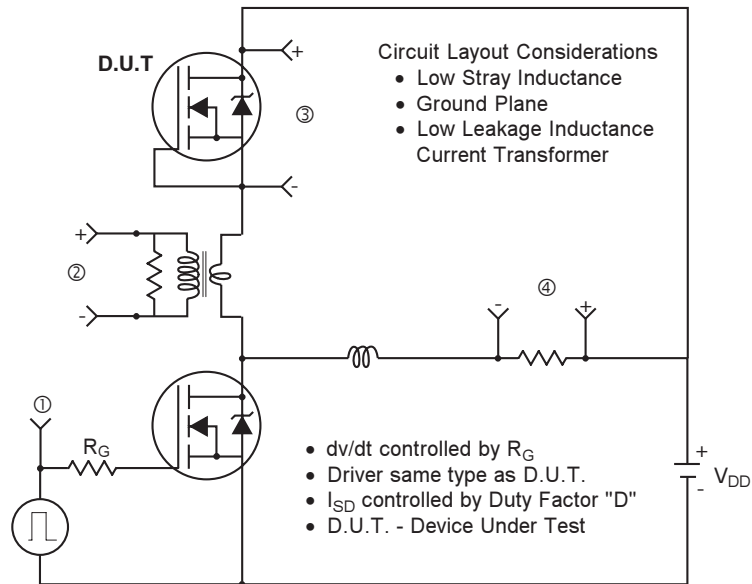


Fig 15b. Basic Gate Charge Waveform

Peak Diode Recovery dv/dt Test Circuit

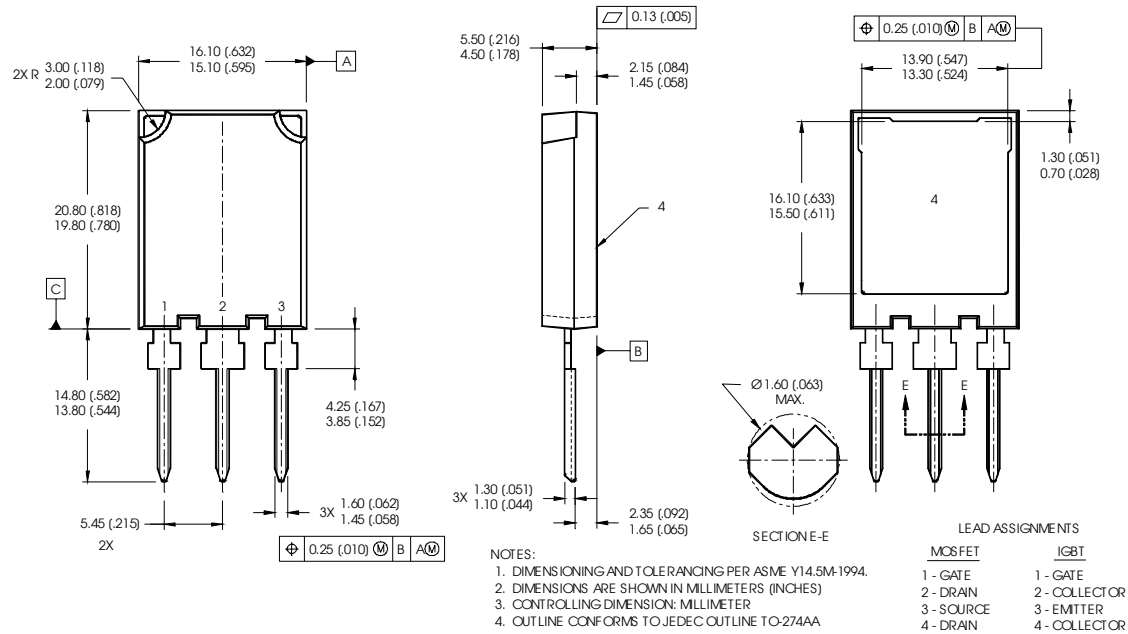


* $V_{GS} = 5V$ for Logic Level Devices

Fig 16. For N-Channel HEXFET® Power MOSFETs

SUPER TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



Super TO-247AC 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.

International
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