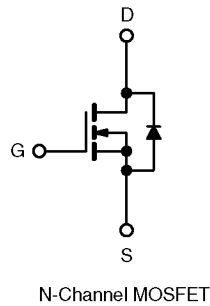
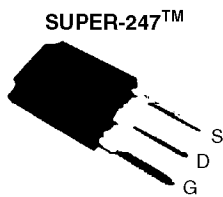


Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	0.087
Q_g (Max.) (nC)	380	
Q_{gs} (nC)	80	
Q_{gd} (nC)	190	
Configuration	Single	



FEATURES

- 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
- Lead (Pb)-free Available



RoHS*
COMPLIANT

APPLICATIONS

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

ORDERING INFORMATION	
Package	SUPER-247™
Lead (Pb)-free	IRFPS40N50LPbF
	SiHFPS40N50L-E3
SnPb	IRFPS40N50L
	SiHFPS40N50L

ABSOLUTE MAXIMUM RATINGS $T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V_{DS}	500	V
Gate-Source Voltage	V_{GS}	± 30	
Continuous Drain Current	V_{GS} at 10 V	$T_C = 25\text{ }^\circ\text{C}$	A
		$T_C = 100\text{ }^\circ\text{C}$	
Pulsed Drain Current ^a	I_{DM}	180	
Linear Derating Factor		4.3	W/ $^\circ\text{C}$
Single Pulse Avalanche Energy ^b	E_{AS}	920	mJ
Repetitive Avalanche Current ^a	I_{AR}	46	A
Repetitive Avalanche Energy ^a	E_{AR}	54	mJ
Maximum Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$	P_D	W
Peak Diode Recovery dV/dt^c	dV/dt	34	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature)	for 10 s	300 ^d	

Notes


- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 0.86\text{ mH}$, $R_G = 25\text{ }^\circ\Omega$, $I_{AS} = 46\text{ A}$ (see fig. 12).
- $I_{SD} \leq 46\text{ A}$, $dI/dt \leq 550\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$.
- 1.6 mm from case.

* Pb containing terminations are not RoHS compliant, exemptions may apply

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient ^a	R_{thJA}	-	40	°C/W
Case-to-Sink, Flat, Greased Surface	R_{thCS}	0.24	-	
Maximum Junction-to-Case (Drain) ^a	R_{thJC}	-	0.23	

Note

a. R_{th} is measured at T_J approximately 90 °C.

SPECIFICATIONS $T_J = 25\text{ °C}$, unless otherwise noted						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	500	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, $I_D = 1\text{ mA}$	-	0.60	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	3.0	-	5.0	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30\text{ V}$	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	-	-	50	μA
		$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ °C}$	-	-	2.0	mA
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 28\text{ A}^b$	-	0.087	0.100	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 46\text{ A}$	21	-	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}, \text{ see fig. 5}$	-	8110	-	pF
Output Capacitance	C_{oss}		-	960	-	
Reverse Transfer Capacitance	C_{rss}		-	130	-	
Output Capacitance	C_{oss}	$V_{GS} = 0\text{ V}$	$V_{DS} = 1.0\text{ V}, f = 1.0\text{ MHz}$	-	11200	-
Effective Output Capacitance	$C_{oss\text{ eff.}}$		$V_{DS} = 400\text{ V}, f = 1.0\text{ MHz}$	-	240	-
Effective Output Capacitance (Energy Related)	$C_{oss\text{ eff. (ER)}}$	$V_{DS} = 0\text{ V to }400\text{ V}^c$	-	310	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}, I_D = 46\text{ A}, V_{DS} = 400\text{ V}, \text{ see fig. 7 and 15}^b$	-	-	380	nC
Gate-Source Charge	Q_{gs}		-	-	80	
Gate-Drain Charge	Q_{gd}		-	-	190	
Internal Gate Resistance	R_G	$f = 1\text{ MHz}, \text{ open drain}$	-	0.90	-	Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 250\text{ V}, I_D = 46\text{ A}, R_G = 0.85\text{ }\Omega, V_{GS} = 10\text{ V}, \text{ see fig. 14a and 14b}^b$	-	27	-	ns
Rise Time	t_r		-	170	-	
Turn-Off Delay Time	$t_{d(off)}$		-	50	-	
Fall Time	t_f		-	69	-	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	46	A
Pulsed Diode Forward Current ^a	I_{SM}		-	-	180	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ °C}, I_S = 46\text{ A}, V_{GS} = 0\text{ V}^b$	-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ °C}, I_F = 46\text{ A}$	-	170	250	ns
		$T_J = 125\text{ °C}, di/dt = 100\text{ A}/\mu\text{s}^b$	-	220	330	
Body Diode Reverse Recovery Charge	Q_{rr}	$T_J = 25\text{ °C}, I_S = 46\text{ A}, V_{GS} = 0\text{ V}^b$	-	705	1060	nC
		$T_J = 125\text{ °C}, di/dt = 100\text{ A}/\mu\text{s}^b$	-	1.3	2.0	
Reverse Recovery Current	I_{RRM}	$T_J = 25\text{ °C}$	-	9.0	-	A
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)				

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- b. Pulse width $\leq 400\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.
- c. $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80 % V_{DS} . $C_{oss\text{ eff. (ER)}}$ is a fixed capacitance that stores the same energy as C_{oss} while V_{DS} is rising from 0 to 80 % V_{DS} .

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

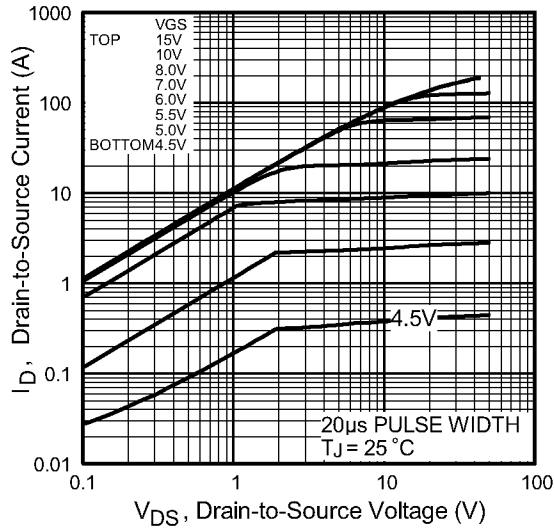


Fig. 1 - Typical Output Characteristics

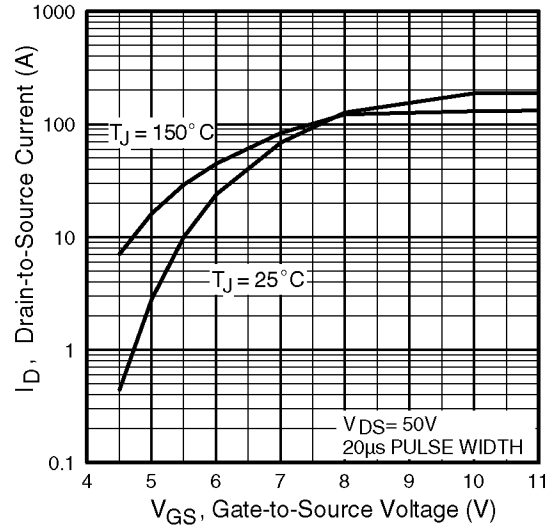


Fig. 3 - Typical Transfer Characteristics

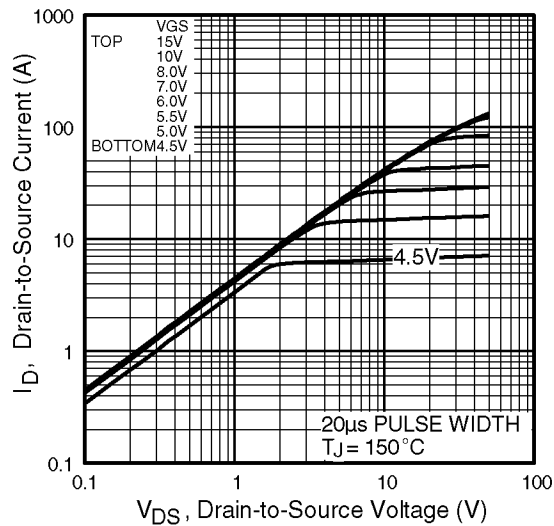


Fig. 2 - Typical Output Characteristics

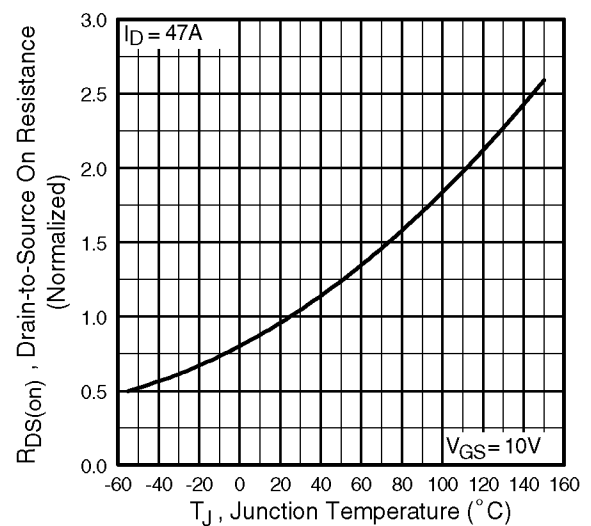


Fig. 4 - Normalized On-Resistance vs. Temperature

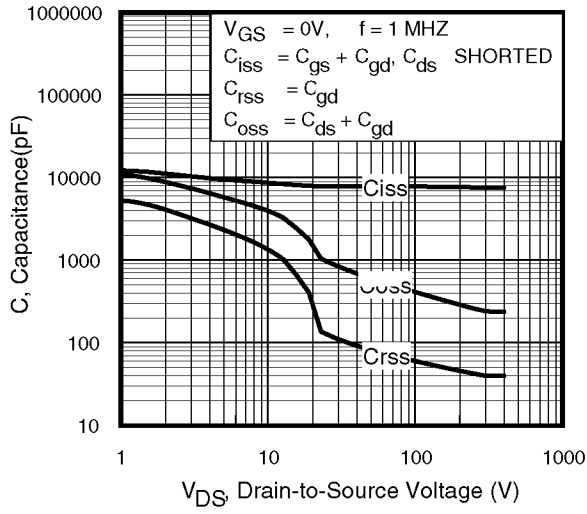


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

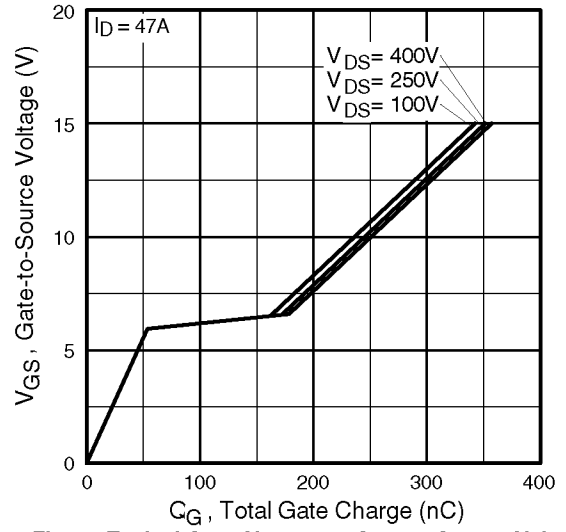


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

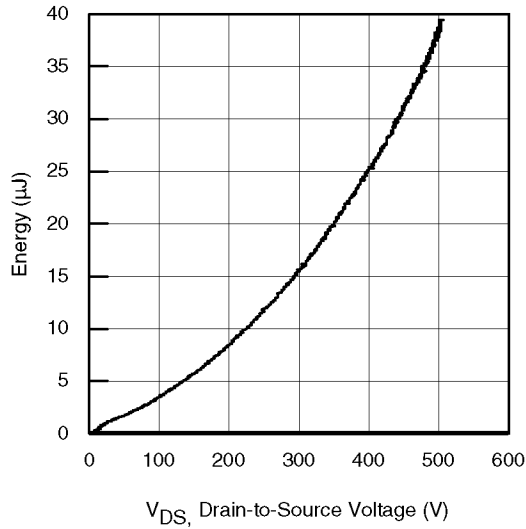


Fig. 6 - Typical Output Capacitance Stored Energy vs. V_{DS}

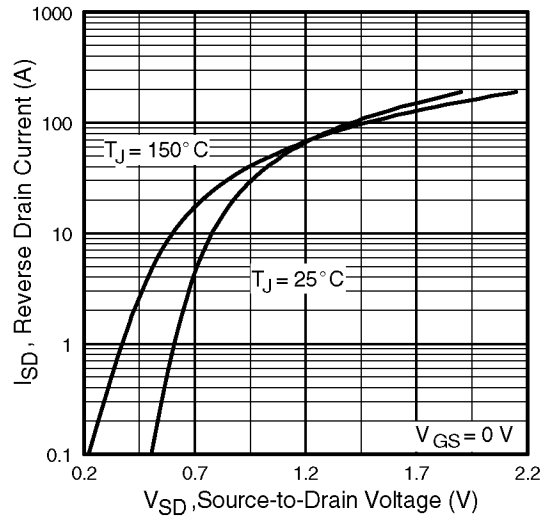


Fig. 8 - Typical Source Drain Diode Forward Voltage

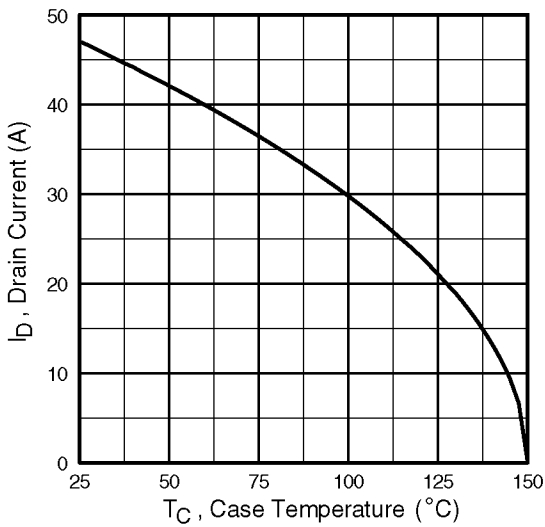


Fig. 9 - Maximum Drain Current vs. Case Temperature

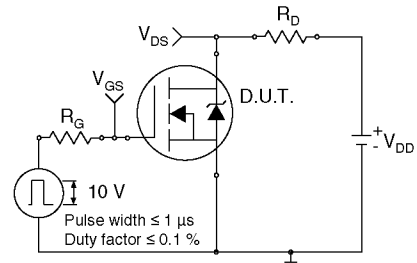


Fig. 10a - Switching Time Test Circuit

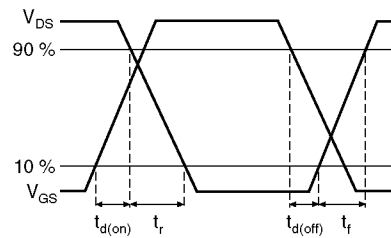


Fig. 10b - Switching Time Waveforms

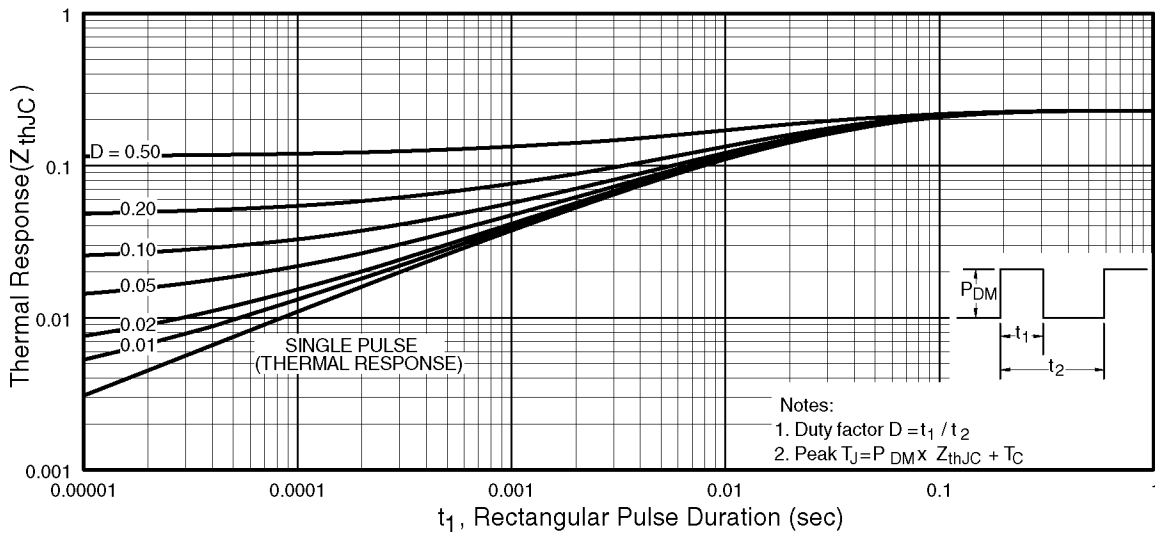


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

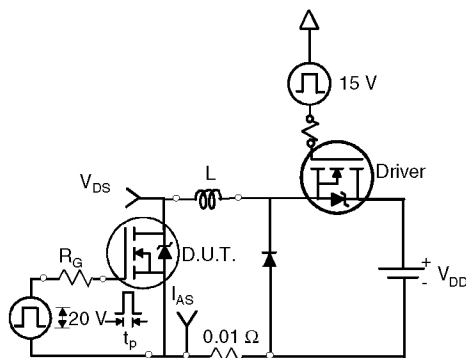


Fig. 12a - Unclamped Inductive Test Circuit

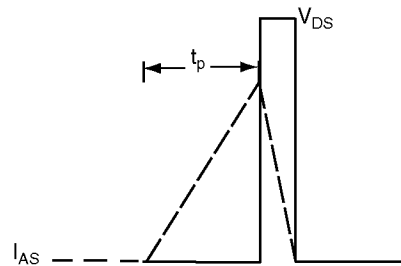


Fig. 12b - Unclamped Inductive Waveforms

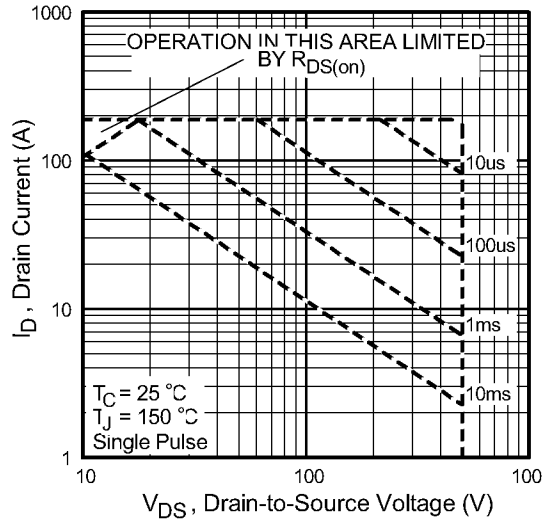


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

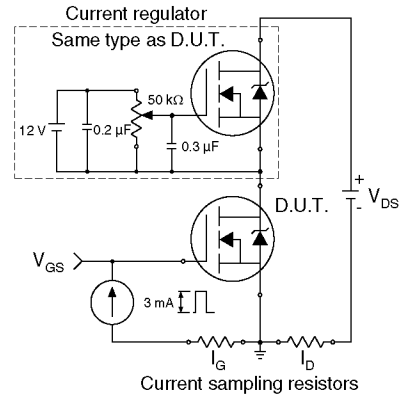


Fig. 13a - Gate Charge Test Circuit

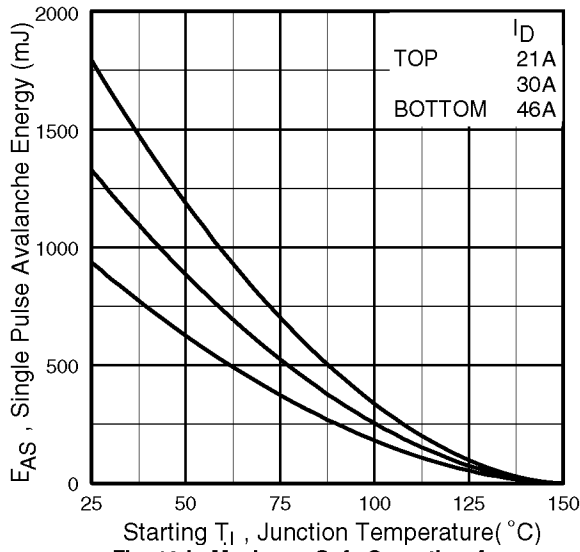


Fig. 12d - Maximum Safe Operating Area

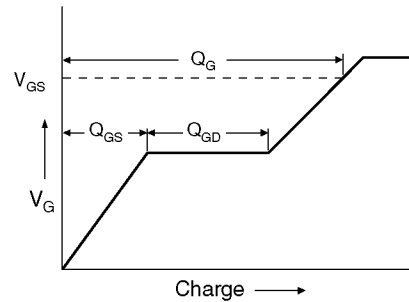


Fig. 13b - Basic Gate Charge Waveform