

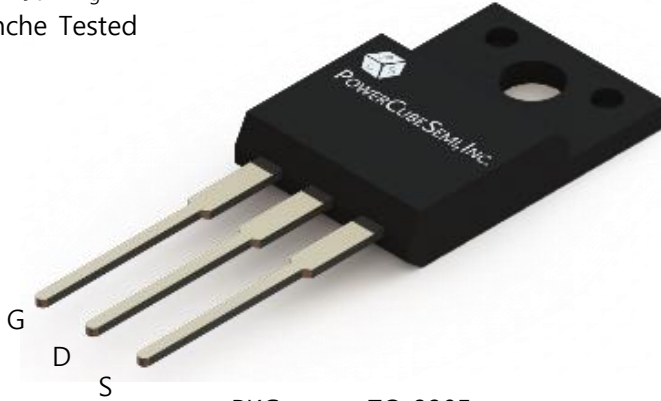
# PM013N060HG

60V 35A 13mΩ Si Single N-ch Enhancement Mode MOSFET with Normal Diode

## Features

### Si N-Ch Enhancement Mode Power MOSFET

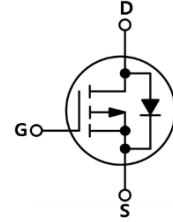
- Rated to 60V at 35Amps @ $T_j = 25^\circ\text{C}$
- Max  $R_{DS(on)} = 13\text{ m}\Omega$
- Typ  $R_{DS(on)} = 10\text{ m}\Omega$
- Gate Charge(Typ.  $Q_g=75\text{ nC}$ )
- 100% Avalanche Tested



PKG type : TO-220F

## Application

- Power switch
- DC/DC converters



## Description

The PM013N060HG uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge. It can be used in a wide variety of applications.

## Absolute Maximum Ratings

Symbol	Parameter	Test Condition	Value	Unit
$BV_{DSS}$	Drain-source breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	60	V
$I_D$	Drain current	$T_c=25^\circ\text{C}$	35	A
$I_{DM}$	Drain current	Pulse width limited by junction temperature	140	A
$V_{GS}$	Gate-source voltage		$\pm 20$	V
$E_{AS}$	Single pulsed avalanche energy	$V_{GS}=10V, R_G=25\Omega$ $V_{DD}=50V, L=0.5mH$	100	mJ
$P_d$	Power dissipation	$T_c=25^\circ\text{C}$	44	W
$T_j$	Operating junction		150	$^\circ\text{C}$
$T_{stg}$	Storage temperature		-55 to 150	$^\circ\text{C}$

## Package Marking and Ordering Information

Device Marking	Device	Package	Packing Method	Tape width	Quantity
PM013N060HG	PM013N060	TO-220F	TUBE	-	50

## Electrical Characteristics of Si MOSFET

Symbol	Parameter	Test Condition	Numerical			Unit
			Min	Typ.	Max.	
$BV_{DSS}$	Drain-source breakdown voltage	$V_{GS} = 0V, I_D = 250\mu A, T_J = 25^\circ C$	60	-	-	V
$I_{DSS}$	Zero gate voltage drain current	$V_{DS} = 60V, V_{GS} = 0V$	-	-	1	$\mu A$
$I_{GSS}$	Gate-source leakage current	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	1.0	1.9	2.4	V
$R_{DS(ON)}$	Static drain-source on state resistance	$V_{GS} = 10V, I_D = 30A$	-	10	13	m $\Omega$
$g_{FS}$	Forward transconductance	$V_{DS} = 5V, I_D = 30A$	-	83	-	S
$t_{d(on)}$	Turn-on Delay time	$V_{DD} = 30V, I_D = 30A, R_G = 3\Omega$	-	60	-	ns
$t_r$	Turn-on Rise time		-	21	-	
$t_{d(off)}$	Turn-off Delay time		-	69	-	
$t_f$	Turn-off Fall time		-	48	-	



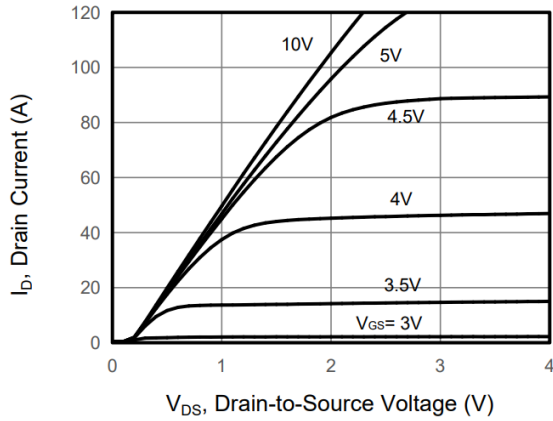
## Electrical Characteristics of Si MOSFET

Symbol	Parameter	Test Condition	Numerical		Unit
			Typ.	Max.	
$R_{\theta JC}$	Thermal resistance, Junction to case		2.8	-	$^{\circ}\text{C}/\text{W}$
$C_{iss}$	Input capacitance	$V_{DS} = 30\text{V}, V_{GS} = 0\text{V},$ $f = 1.0\text{MHz}$	3006	-	pF
$C_{oss}$	Output capacitance		161	-	
$C_{rss}$	Reverse transfer capacitance		143	-	
$Q_{g(\text{tot})}$	Total gate charge at 10V	$V_{DD} = 30\text{V}, I_D = 30\text{A}$ $V_{GS} = 10\text{V}$	75	-	nC
$Q_{gs}$	Gate to source gate charge		13.5	-	
$Q_{gd}$	Gate to drain "Miller" charge		19.5	-	

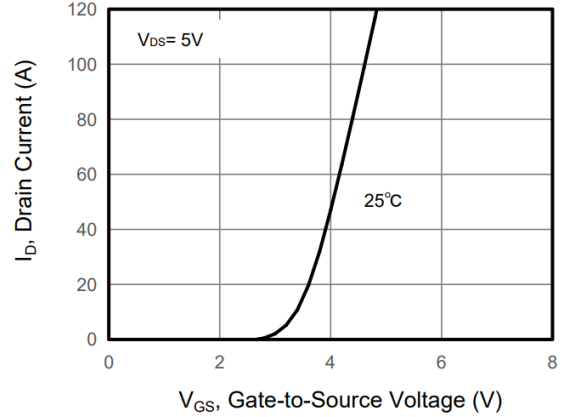
## Electrical Characteristics of Si Diode

Symbol	Parameter	Test Condition	Numerical		Unit
			Typ.	Max.	
$I_S$	Maximum continuous drain to source diode forward current	$T_c = 25^{\circ}\text{C}$	-	35	A
$V_{SD}$	Drain to source diode forward voltage	$I_{SD} = 30\text{A}, V_{GS} = 0\text{V}$	-	1.2	V
$T_{rr}$	Reverse recovery time	$I_F = 30\text{A}, V_{GS} = 0\text{V},$ $di_F/dt = 100\text{A}/\mu\text{s}$	87	-	ns
$Q_{rr}$	Reverse recovery charge		147	-	nC

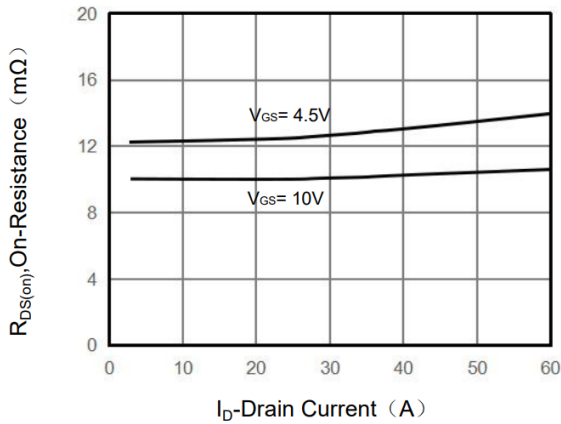
# Typical Characteristics



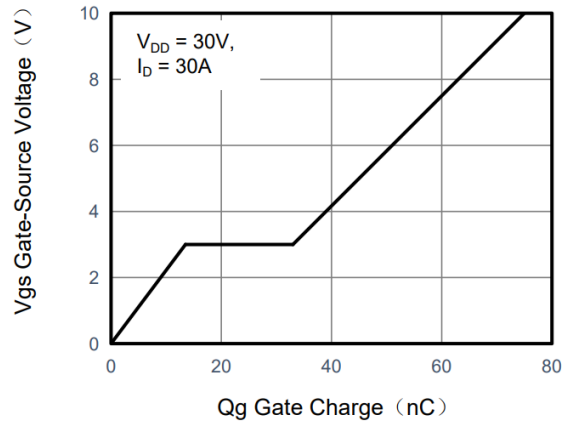
**Figure 1. Output Characteristics**



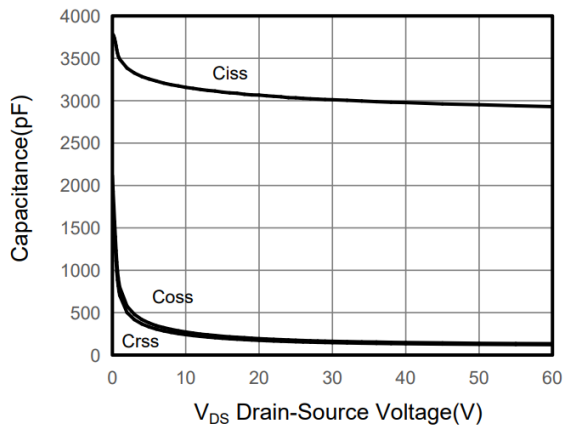
**Figure 2. Transfer Characteristics**



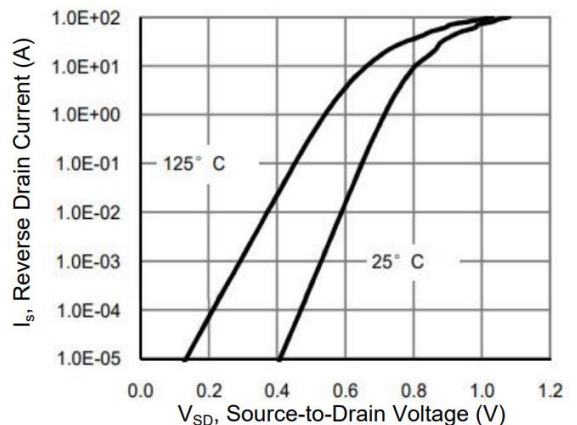
**Figure 3. Drain to Source On-Resistance**



**Figure 4. Gate Charge**



**Figure 5. Capacitance Characteristics**



**Figure 6. Source to Drain Diode Forward**

# Typical Characteristics

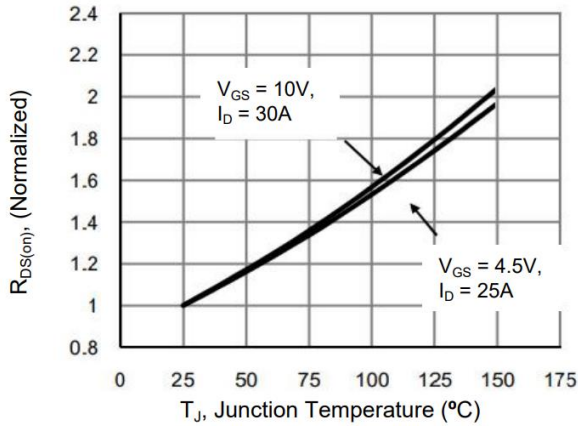


Figure 7. Drain to Source On-Resistance

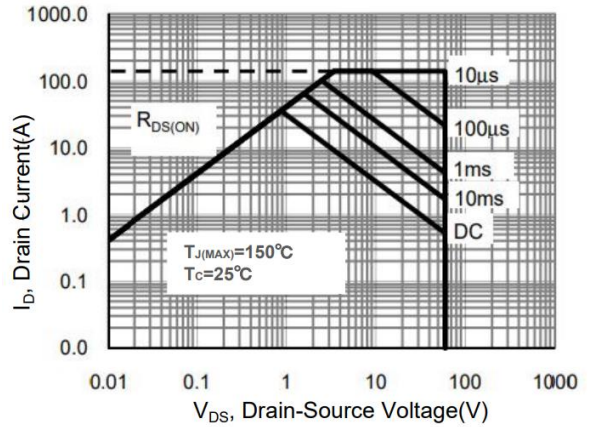


Figure 8. Safe Operation Area

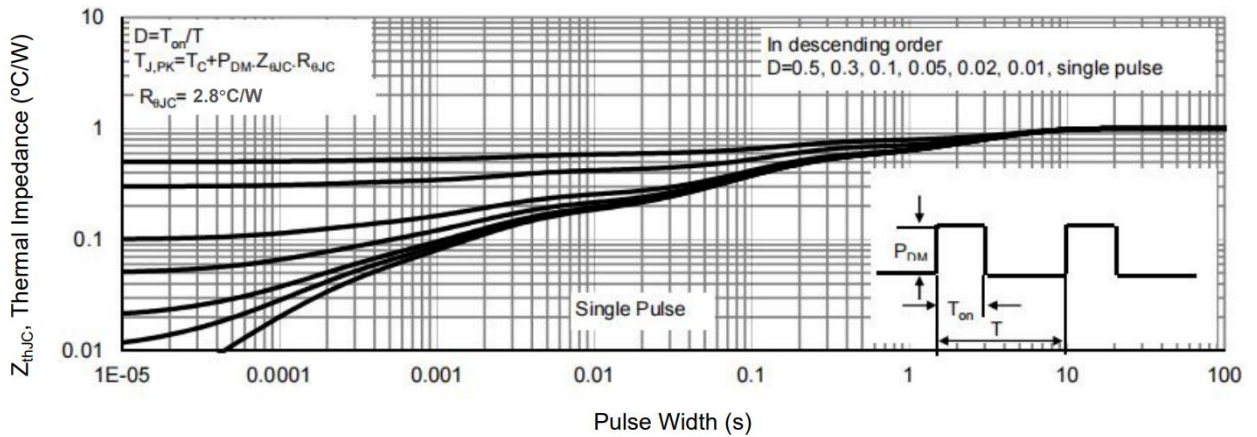
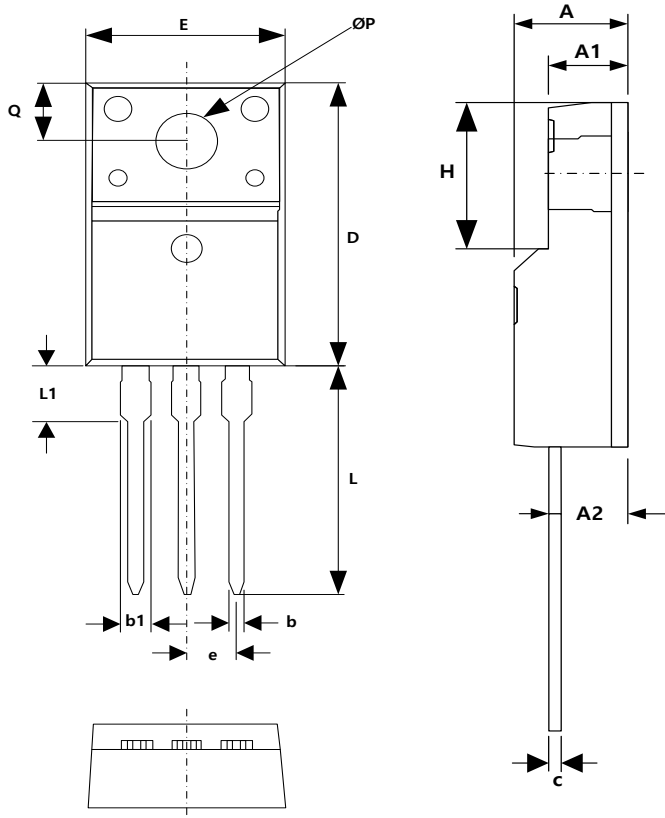


Figure 9. Normalized Maximum Transient Thermal Impedance

### Package Outline

Unit : mm



SYMBOL	DIMENSIONS		
	MIN	NOM	MAX
<b>A</b>	4.60	4.70	4.80
<b>A1</b>	2.44	2.54	2.64
<b>A2</b>	2.15	2.45	2.75
<b>b</b>	0.70	0.80	0.90
<b>b1</b>	1.15	1.35	1.55
<b>c</b>	0.50	0.60	0.70
<b>D</b>	15.30	15.80	16.30
<b>E</b>	9.90	10.10	10.30
<b>e</b>	4.98	5.08	5.18
<b>H</b>	6.40	6.60	6.80
<b>L</b>	13.05	13.55	14.05
<b>L1</b>	3.00	3.30	3.60
<b>ØP</b>	3.00	3.20	3.40
<b>Q</b>	3.10	3.30	3.50