

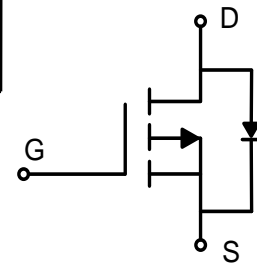
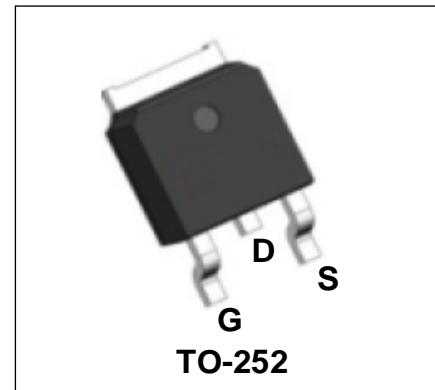
## 60V P-Channel Enhancement Mode Power MOSFET

### Description

WMO13P06T1 uses advanced power trench technology that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

### Features

- $V_{DS} = -60V$ ,  $I_D = -13A$   
 $R_{DS(on)} < 90m\Omega @ V_{GS} = -10V$   
 $R_{DS(on)} < 128m\Omega @ V_{GS} = -4.5V$
- Extremely Low Switching Loss
- Excellent Stability and Uniformity
- Low Gate Charge
- 100% EAS Guaranteed



### Applications

- Power Management
- Portable Equipment

### Absolute Maximum Ratings

Parameter		Symbol	Value	Unit
Drain-Source Voltage		$V_{DS}$	-60	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	V
Continuous Drain Current <sup>1</sup>	$T_C = 25^\circ C$	$I_D$	-13	A
	$T_C = 100^\circ C$		-8	
Pulsed Drain Current <sup>2</sup>		$I_{DM}$	-41	A
Single Pulse Avalanche Energy <sup>3</sup>		<b>EAS</b>	20	mJ
Avalanche Current		$I_{AS}$	-20	A
Total Power Dissipation <sup>4</sup>	$T_C = 25^\circ C$	$P_D$	29.8	W
Operating Junction and Storage Temperature Range		$T_J, T_{STG}$	-55 to 150	$^\circ C$

### Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction-to-Ambient <sup>1</sup>	$R_{\theta JA}$	60	$^\circ C/W$
Thermal Resistance from Junction-to-Case <sup>1</sup>	$R_{\theta JC}$	4.2	$^\circ C/W$

**Electrical Characteristics**  $T_c = 25^\circ\text{C}$ , unless otherwise noted

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	
<b>Static Characteristics</b>							
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = -250\mu A$	-60	-	-	V	
Gate-body Leakage current	$I_{GSS}$	$V_{DS} = 0V, V_{GS} = \pm 20V$	-	-	$\pm 100$	nA	
Zero Gate Voltage Drain Current	$T_J = 25^\circ\text{C}$	$I_{DSS}$	$V_{DS} = -48V, V_{GS} = 0V$	-	-	-1	$\mu A$
	$T_J = 55^\circ\text{C}$			-	-	-5	
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\mu A$	-1	-1.6	-2.5	V	
Drain-Source On-Resistance <sup>2</sup>	$R_{DS(on)}$	$V_{GS} = -10V, I_D = -10A$	-	72	90	m $\Omega$	
		$V_{GS} = -4.5V, I_D = -5A$		86	128		
<b>Dynamic Characteristics</b>							
Input Capacitance	$C_{iss}$	$V_{DS} = -30V, V_{GS} = 0V,$ $f = 1\text{MHz}$	-	1015	-	pF	
Output Capacitance	$C_{oss}$		-	50	-		
Reverse Transfer Capacitance	$C_{rss}$		-	35	-		
<b>Switching Characteristics</b>							
Gate Resistance	$R_g$	$V_{DS} = 0V, V_{GS} = 0V,$ $f = 1\text{MHz}$	-	15.5	-	$\Omega$	
Total Gate Charge	$Q_g$	$V_{GS} = -4.5V, V_{DS} = -12V,$ $I_D = -5A$	-	15	-	nC	
Gate-Source Charge	$Q_{gs}$		-	2.1	-		
Gate-Drain Charge	$Q_{gd}$		-	7	-		
Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = -4.5V, V_{DS} = -12V,$ $I_D = -5A$	-	6.9	-	nS	
Rise Time	$t_r$		-	22.3	-		
Turn-Off Delay Time	$t_{d(off)}$		-	41.9	-		
Fall Time	$t_f$		-	10.6	-		
<b>Drain-Source Body Diode Characteristics</b>							
Diode Forward Voltage <sup>2</sup>	$V_{SD}$	$I_S = -1A, V_{GS} = 0V$	-	-	-1	V	
Continuous Source Current <sup>1,5</sup>	$I_S$	$V_G = V_D = 0V$ , Force Current	-	-	-13	A	

## Notes:

1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
2. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
3. The EAS data shows Max. rating. The test condition is  $V_{DD} = -25V, V_{GS} = -10V, L = 0.1\text{mH}, I_{AS} = -20A$
4. The power dissipation is limited by  $150^\circ\text{C}$  junction temperature
5. The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications, should be limited by total power dissipation.

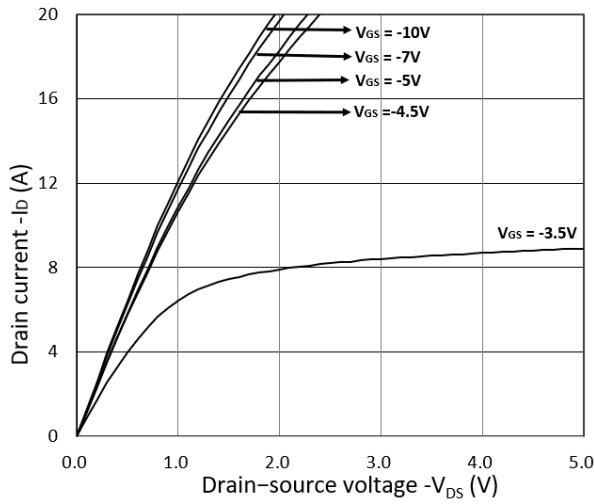


Figure 1. Output Characteristics

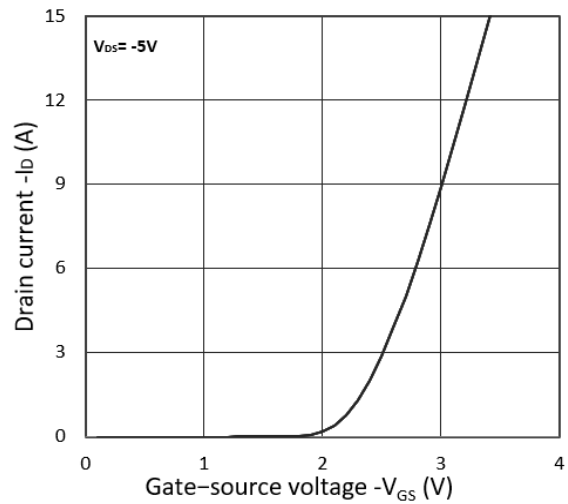


Figure 2. Transfer Characteristics

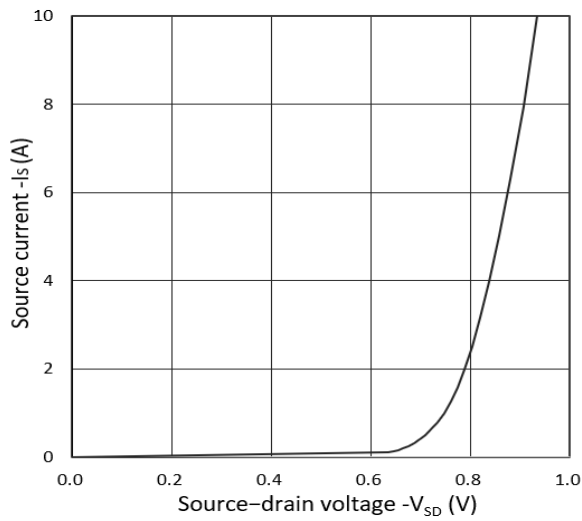


Figure 3. Forward Characteristics of Reverse

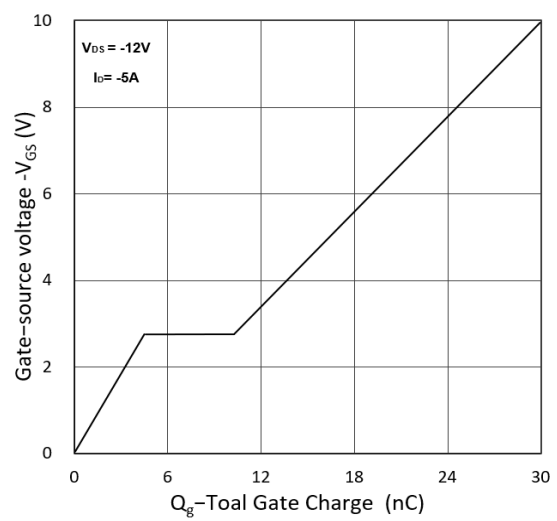


Figure 4. Gate Charge Characteristics

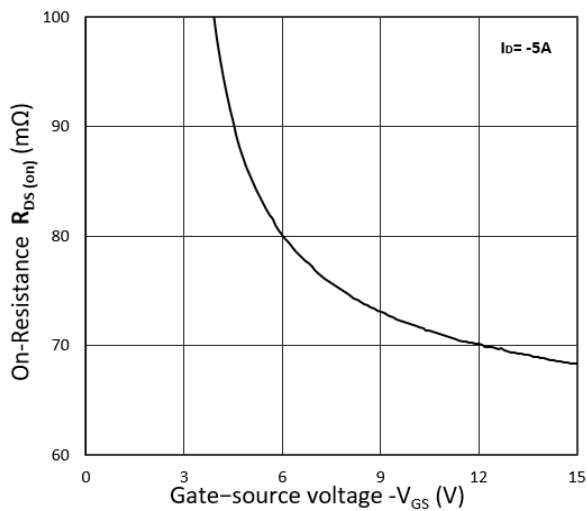


Figure 5.  $R_{DS(ON)}$  vs.  $V_{GS}$

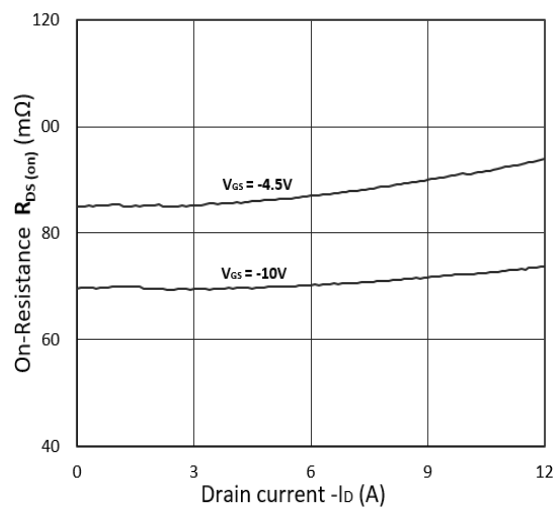


Figure 6.  $R_{DS(ON)}$  vs.  $I_D$

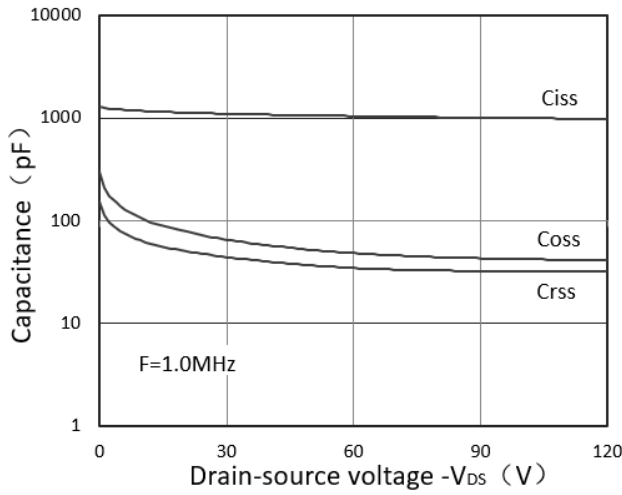


Figure 7. Capacitance Characteristics

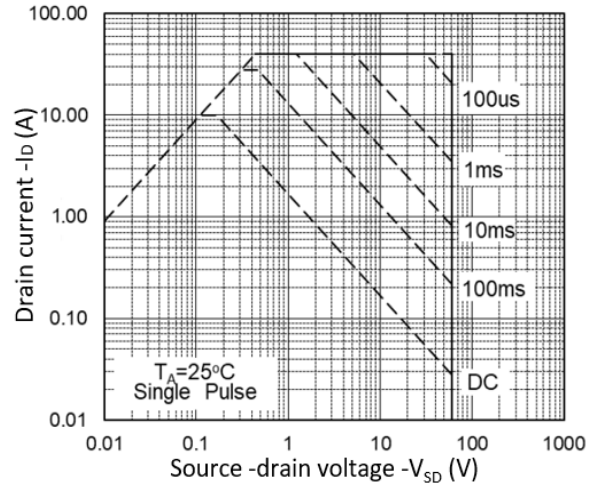


Figure 8. Safe Operating Area

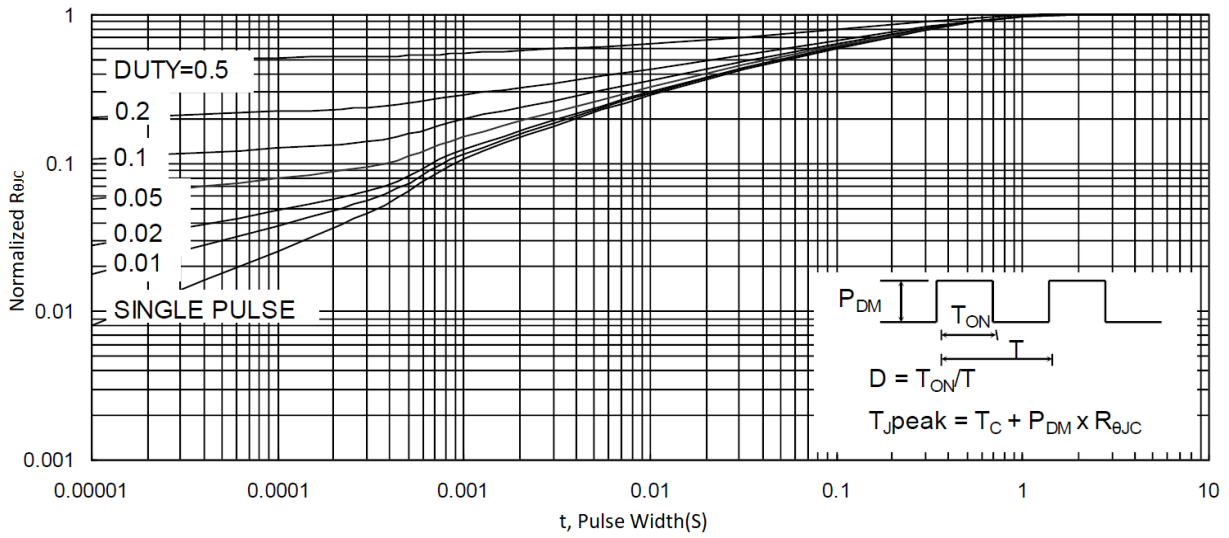


Figure 9. Normalized Maximum Transient Thermal Impedance

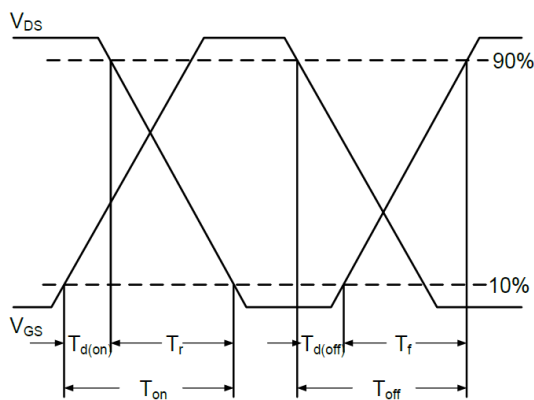


Figure 10. Switching Time Waveform

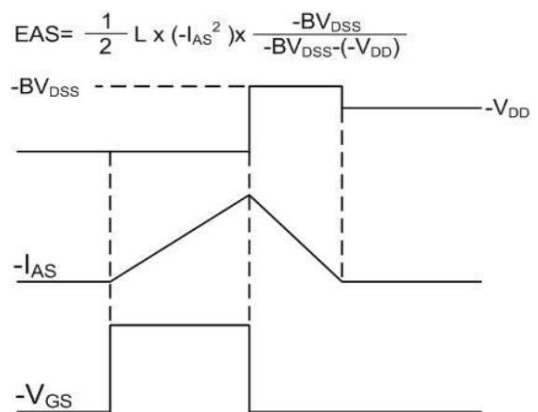
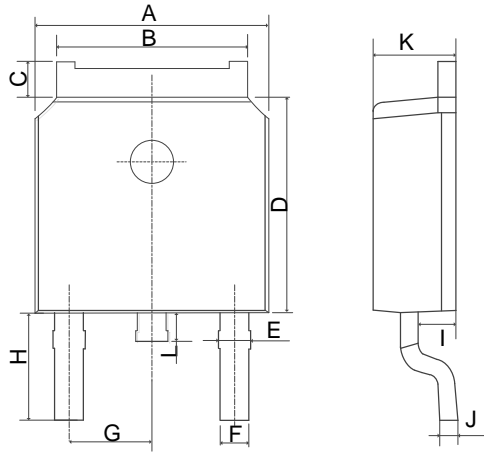


Figure 11. Unclamped Inductive Switching Waveform

## Mechanical Dimensions for TO-252



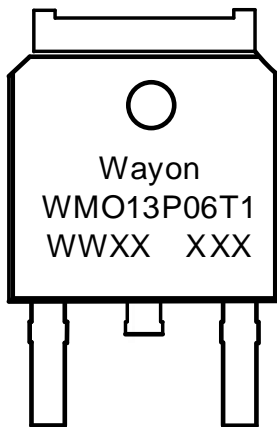
## COMMON DIMENSIONS

SYMBOL	MM	
	MIN	MAX
A	6.40	6.80
B	5.13	5.50
C	0.88	1.28
D	5.90	6.22
E	0.68	1.10
F	0.68	0.91
G	2.29REF	
H	2.90REF	
I	0.85	1.17
J	0.51REF	
K	2.10	2.50
L	0.40	1.00

## Ordering Information

Part	Package	Marking	Packing method
WMO13P06T1	TO-252	WMO13P06T1	Tape and Reel

## Marking Information



WMO13P06T1= Device code

WWXX XXX= Date code

## Contact Information

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