

# MJ P-Channel Enhancement Mode Power MOSFET

## Description

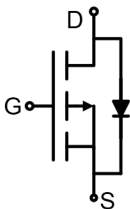
The MJ2333Y uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a load switch or in PWM applications.

### General Features

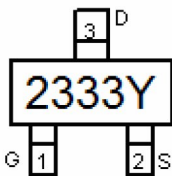
- ◆  $V_{DS}=-12V, I_D=-6A$   
 $R_{DS(ON)}<45m\Omega$  @  $V_{GS}=-2.5V$   
 $R_{DS(ON)}<30m\Omega$  @  $V_{GS}=-4.5V$
- ◆ High power and current handing capability
- ◆ Lead free product is acquired
- ◆ Surface Mount Package

### Application

- ◆ PWM applications
- ◆ Load switch
- ◆ Power management



Schematic diagram



Marking and pin Assignment



SOT-23 top view

## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
2333Y	MJ2333Y	SOT-23-3L	Ø180mm	8 mm	3000 units

## Absolute Maximum Ratings (Tc =25 °Cunless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-12	V
Gate-Source Voltage	$V_{GS}$	±12	V
Drain Current -Continuous	$I_D$	-6	A
Drain Current-Pulsed <sup>(Note 1)</sup>	$I_{DM}$	-20	A
Maximum Power Dissipation	$P_D$	1.8	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	°C

## Thermal Characteristic

Thermal Resistance,Junction-to-Ambient <sup>(Note 2)</sup>	$R_{\theta JA}$	69	°C/W
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Electrical Characteristics (T<sub>A</sub> =25℃unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =-250μA	-12	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-12V,V <sub>GS</sub> =0V	-	-	-1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> =±12V,V <sub>DS</sub> =0V	-	-	±100	nA
On Characteristics <sup>(Note 3)</sup>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =-250μA	-0.4	-0.65	-1.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-6A	-	19	30	mΩ
		V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-5A	-	26	45	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-5V,I <sub>D</sub> =-6A	-	17	-	S
Dynamic Characteristics <sup>(Note 4)</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-6V,V <sub>GS</sub> =0V, F=1.0MHz	-	1100	-	PF
Output Capacitance	C <sub>OSS</sub>		-	390	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	300	-	PF
Switching Characteristics <sup>(Note 4)</sup>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-6V,I <sub>D</sub> =-1A , R <sub>L</sub> =6Ω,V <sub>GS</sub> =-4.5V, R <sub>g</sub> =6Ω	-	25	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	45	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	72	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	60	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-6V,I <sub>D</sub> =-6A, V <sub>GS</sub> =-4.5V	-	11.5	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	1.5	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	3.2	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage <sup>(Note 3)</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V,I <sub>S</sub> =-1.0A	-	-	-1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>		-	-	-6	A

Notes:

- ① Repetitive Rating: Pulse width limited by maximum junction temperature.
- ② Surface Mounted on FR4 Board, t ≤ 10 sec.
- ③ Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
- ④ Guaranteed by design, not subject to production

# Typical Electrical and Thermal Characteristics

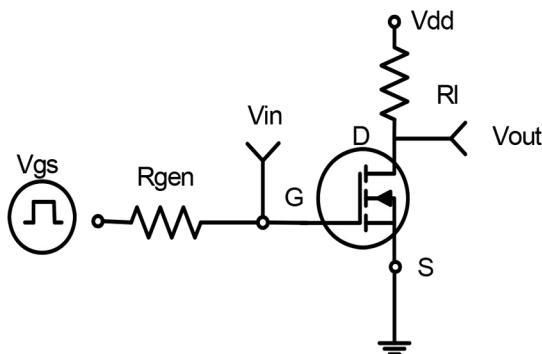


Figure 1 Switching Test Circuit

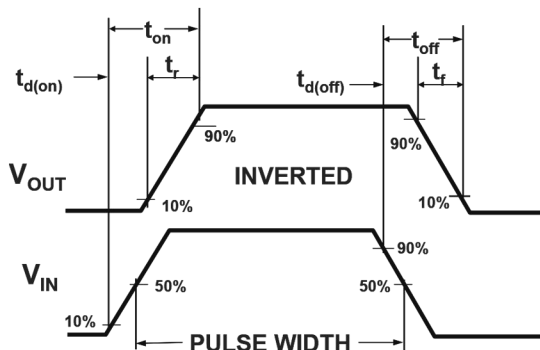
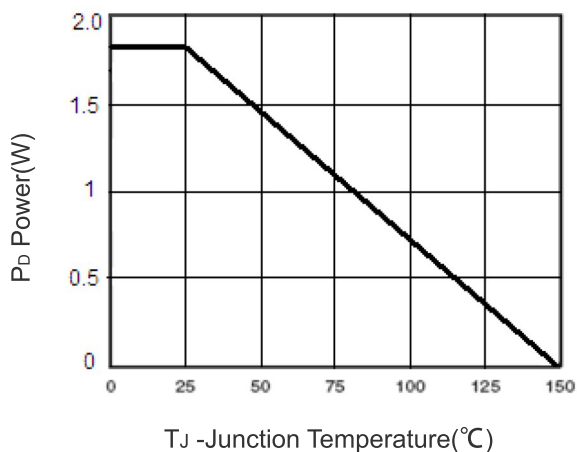
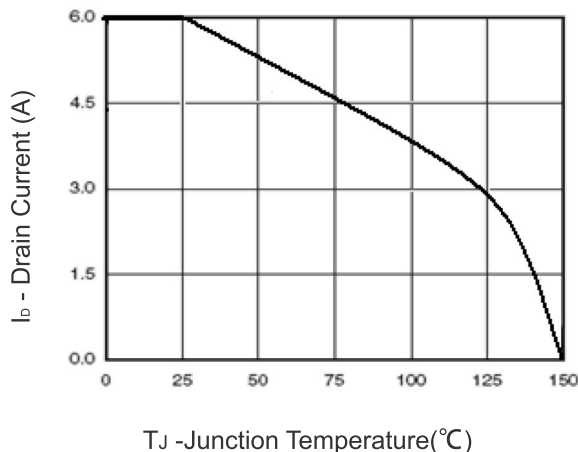


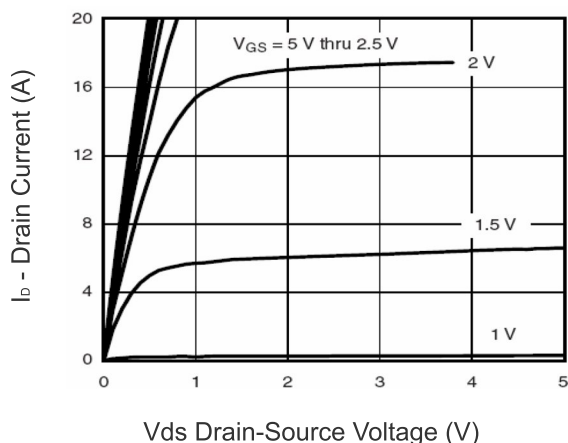
Figure 2 Switching Waveforms



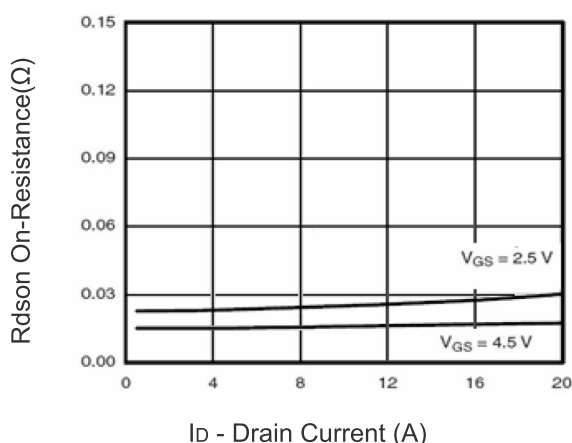
T<sub>J</sub> -Junction Temperature(°C)  
Figure 3 Power Dissipation



T<sub>J</sub> -Junction Temperature(°C)  
Figure 4 Drain Current



V<sub>DS</sub> Drain-Source Voltage (V)  
Figure 5 Output Characteristics



ID - Drain Current (A)  
Figure 6 Drain-Source On-Resistance

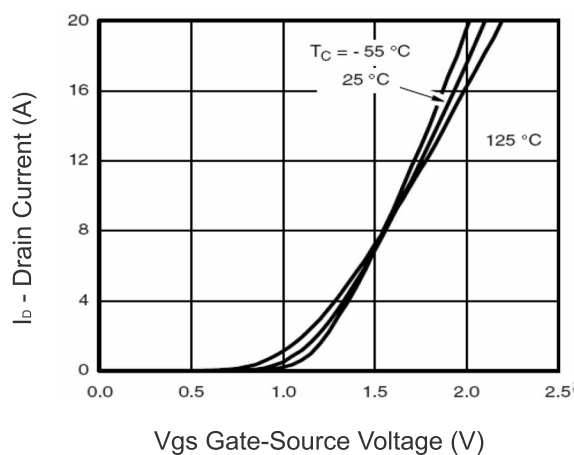


Figure 7 Transfer Characteristics

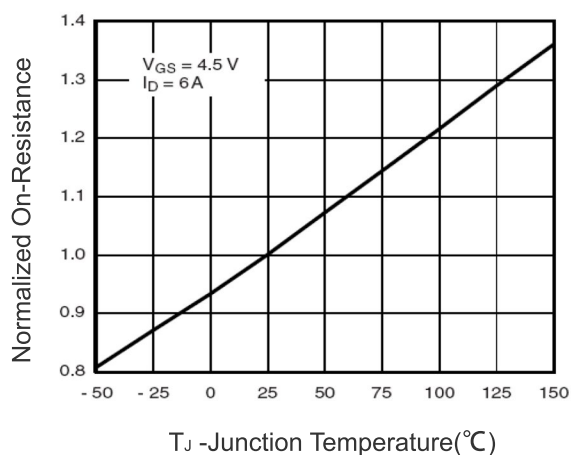


Figure 8 Drain-Source On-Resistance

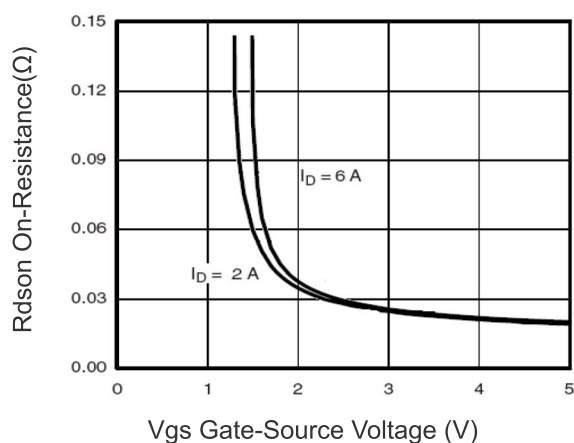


Figure 9 Rdson vs Vgs

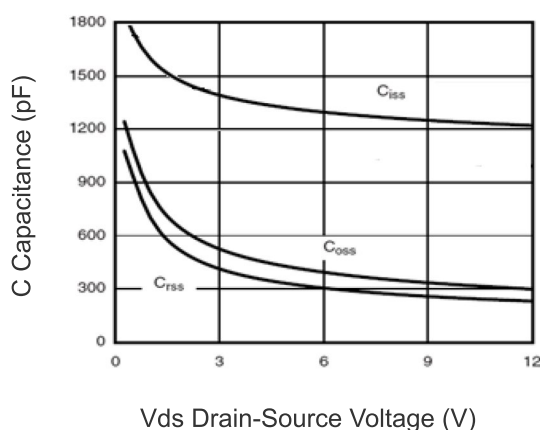


Figure 10 Capacitance vs Vds

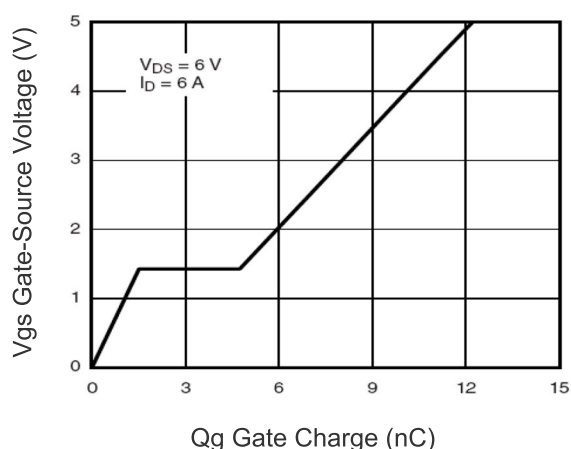


Figure 11 Gate Charge

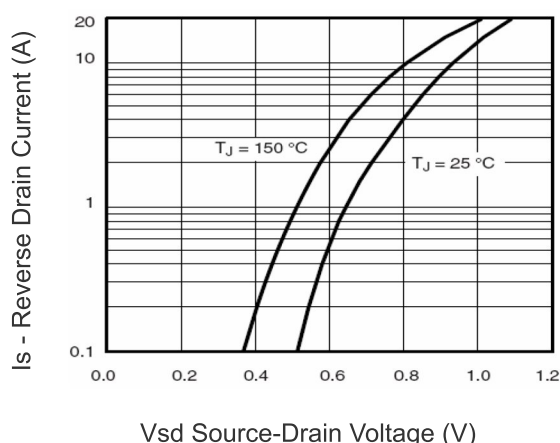


Figure 12 Source- Drain Diode Forward

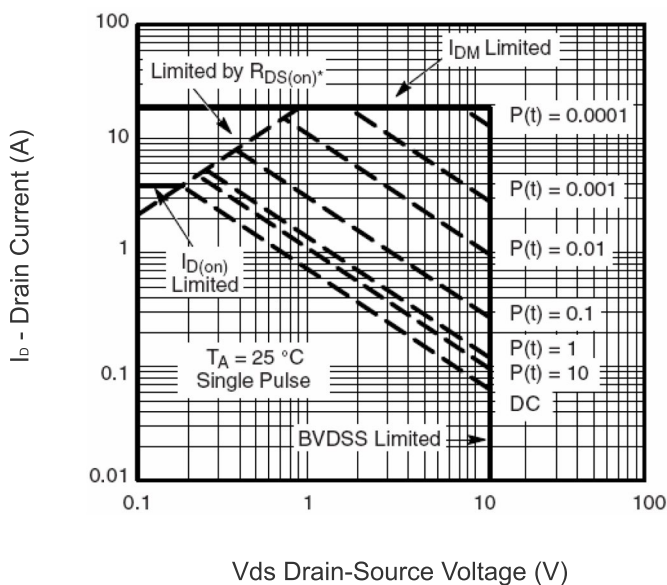


Figure 13 Safe Operation Area

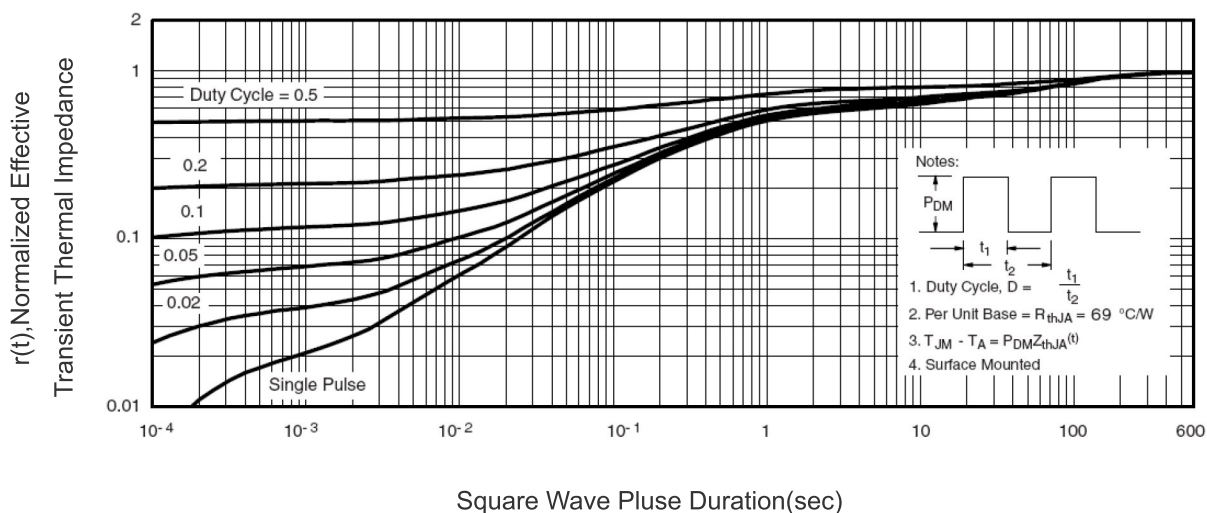
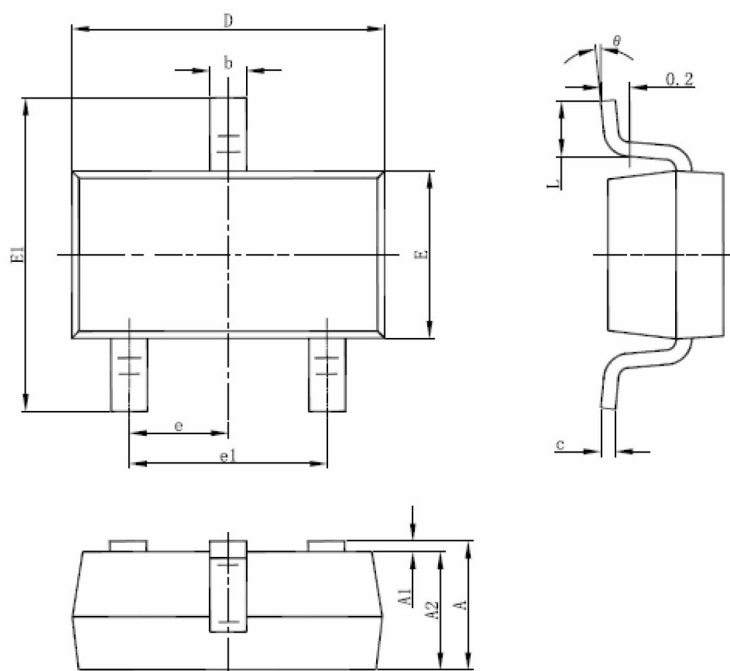


Figure 14 Normalized Maximum Transient Thermal Impedance

# SOT-23-3L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

## Notes:

- ① All dimensions are in millimeters.
- ② Tolerance  $\pm 0.10\text{mm}$  (4 mil) unless otherwise specified
- ③ Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
- ④ Dimension L is measured in gauge plane.
- ⑤ Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

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