



## P-Channel 60V (D-S) MOSFET

### General Description

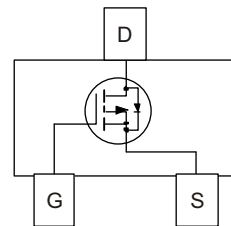
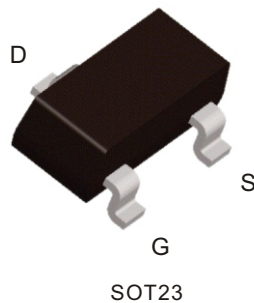
This miniature surface mount MOSFET uses advanced Trench process, low  $R_{DS(ON)}$  assures minimal power loss and energy convert, which makes this device ideal for use in power management circuit.

### Applications

- Load switch
- DC-DC converters
- Power management

### Features

- $V_{DS}$  (V) = -60V
- $I_D$  (A) = -2.7A ( $V_{GS} = -10V$ )
- $R_{DS(on)}$  = 110 m $\Omega$  @  $V_{GS} = -10V$
- $R_{DS(on)}$  = 160 m $\Omega$  @  $V_{GS} = -4.5V$
- Low gate charge
- Fast switching speed
- High performance trench technology



### Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ Unless Otherwise Noted)

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	-60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current <sup>a</sup>	$I_D$	$T_A=25^\circ\text{C}$	-2.7
		$T_A=70^\circ\text{C}$	-2.2
Pulsed Drain Current <sup>b</sup>	$I_{DM}$	-11	A
Continuous Source Current (Diode Conduction) <sup>a</sup>	$I_S$	-1.0	A
Power Dissipation <sup>a</sup>	$P_D$	$T_A=25^\circ\text{C}$	1.4
		$T_A=70^\circ\text{C}$	1.0
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$

### Thermal Resistance Ratings

Parameter	Symbol	Maximum	Units
Maximum Junction-to-Ambient <sup>a</sup>	$R_{\theta JA}$	$t \leq 10 \text{ sec}$	90
		Steady-State	130



**Package Outlines and Ordering Information**

Device	Device Marking	Reel Size	Tape Width	Quantity
MI3461	S60P	7"	8mm	3000 units

**Specifications (TA = 25°C Unless Otherwise Noted)**

Parameter	Symbol	Test Conditions	Limits			Units
			Min	Typ	Max	
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-60			V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.0	-2.0	-3.0	
Gate-Body Leakage	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 20V$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-60V, V_{GS}=0V$			-1	uA
		$V_{DS}=-60V, V_{GS}=0V, T_J=55^\circ C$			-10	
On-State Drain Current <sup>c</sup>	$I_{D(on)}$	$V_{DS}=-20V, V_{GS}=-4.5V$	-11			A
Drain-Source On-Resistance <sup>c</sup>	$R_{DS(on)}$	$V_{GS}=-10V, I_D=-3.5A$		88	110	mΩ
		$V_{GS}=-4.5V, I_D=-2.0A$		120	160	
Forward Transconductance <sup>c</sup>	$g_{fs}$	$V_{DS}=-5V, I_D=-3.5A$		12		S
Diode Forward Voltage	$V_{SD}$	$I_S=-1.0A, V_{GS}=0V$		-0.8	-1.2	V
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=-30V, V_{GS}=0V$ $f=1MHz$		745		pF
Output capacitance	$C_{oss}$			69		
Reverse Transfer Capacitance	$C_{rss}$			42		
<b>Switching</b>						
Total Gate Charge	$Q_g$	$V_{DS}=-30V, V_{GS}=-10V$ $I_D=-2.7A$		13.5		nC
Gate-Source Charge	$Q_{gs}$			1.5		
Gate-Drain Charge	$Q_{gd}$			3.2		
Turn-On Delay Time	$t_{d(on)}$	$V_{DS}=-30V, I_D=1.0A,$ $R_G=6\text{ ohm}, V_{GEN}=-4.5V$		12		ns
Rise Time	$t_r$			12		
Turn-Off Delay Time	$t_{d(off)}$			65.8		
Fall-Time	$t_f$			22		

Notes : a. Surface Mounted on 1" x 1" FR4 Board.  
 b. Pulse width limited by maximum junction temperature  
 c. Pulse test: PW ≤ 300us duty cycle ≤ 2%.



Typical Electrical and Thermal Characteristics

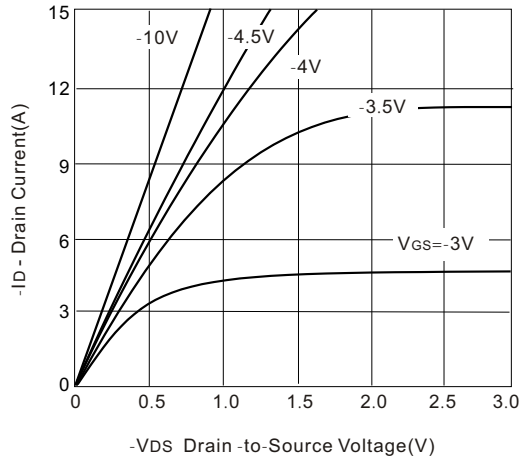


Figure 1: Output Characteristics

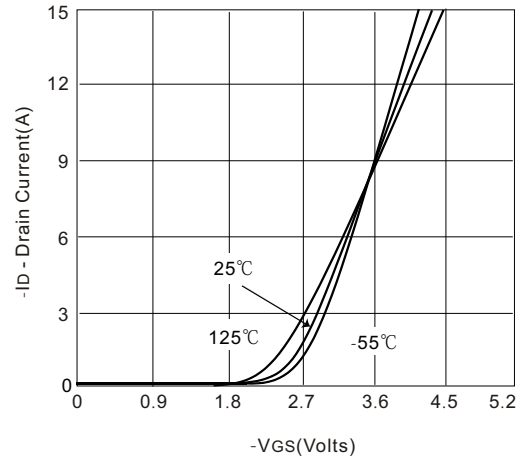


Figure 2: Transfer Characteristics

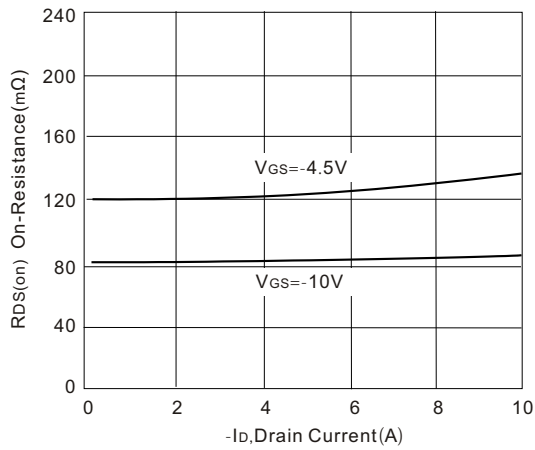


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

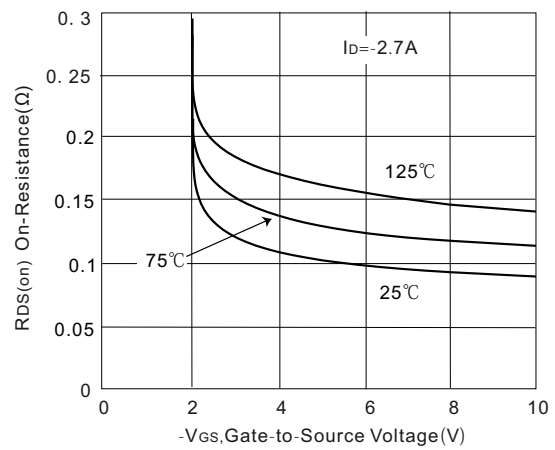


Figure 4: On-Resistance vs. Gate-Source Voltage

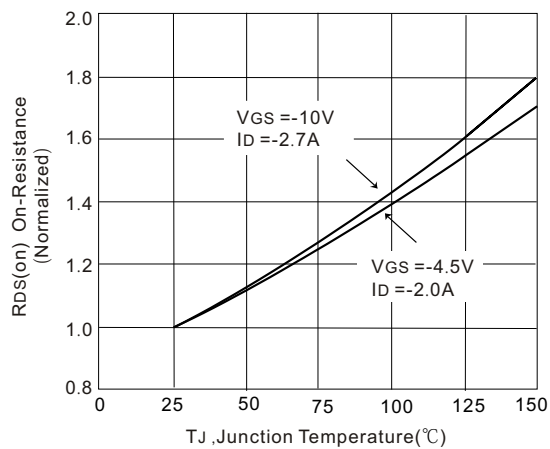


Figure 5: On-Resistance Variation With Temperature

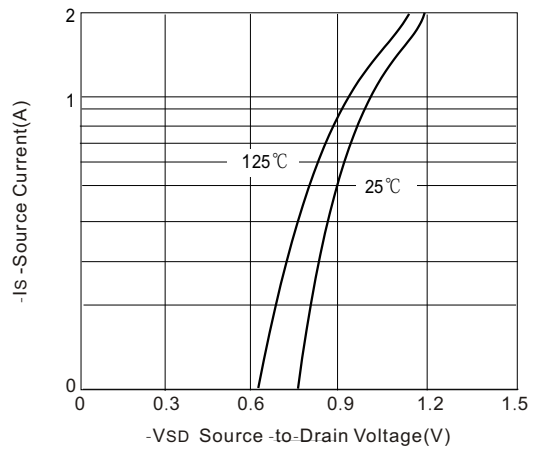


Figure 6: Source-Drain Forward Voltage



Typical Electrical and Thermal Characteristics

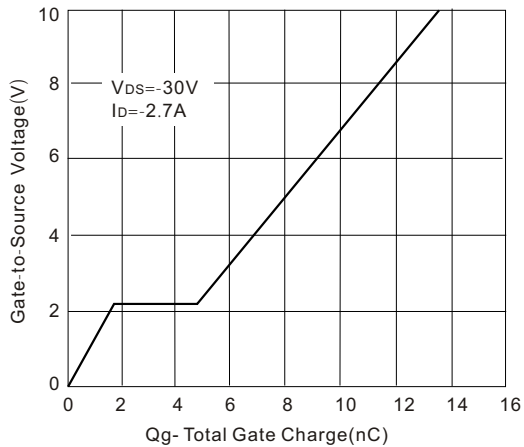


Figure 7: Gate - to - Source and

Drain - to - Source Voltage vs. Total Charge

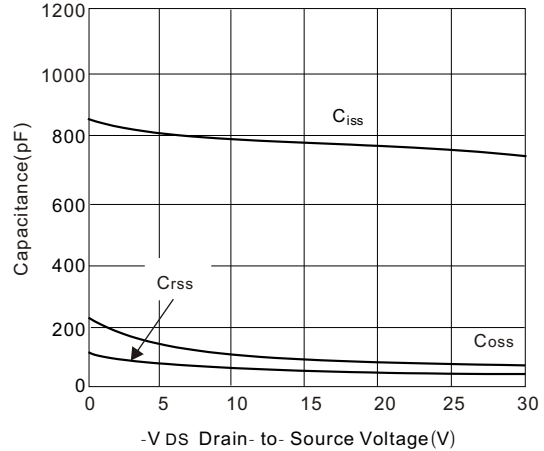


Figure 8: Capacitance

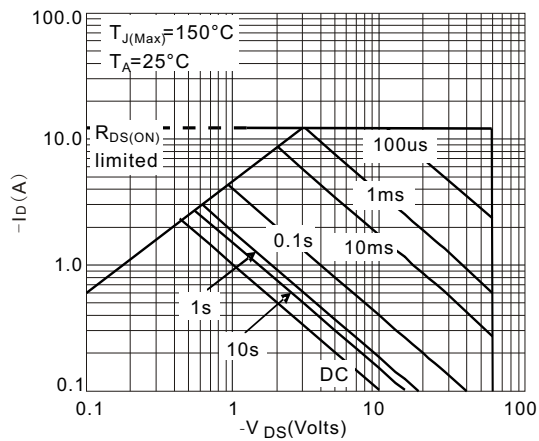


Figure 9: Maximum Forward Biased Safe Operating Area (Note d)

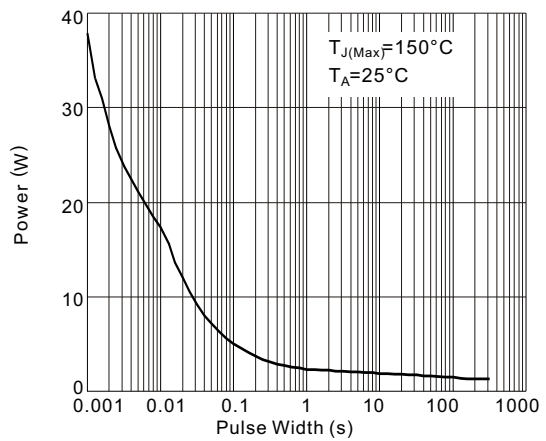


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note d)

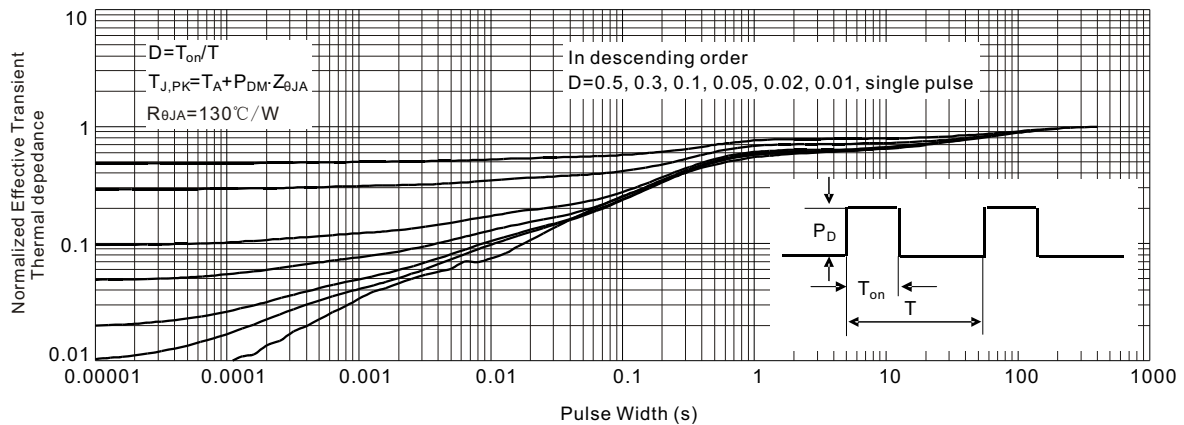


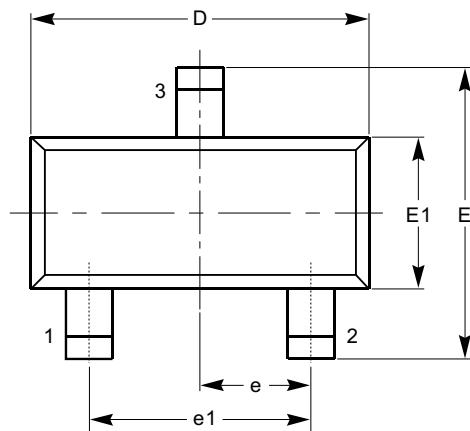
Figure 11: Normalized Maximum Transient Thermal Impedance

Note d: These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

**Package Outline**

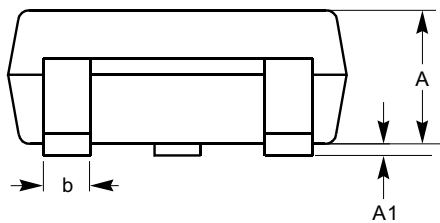
**SOT23\_3Lead**

Unit: mm

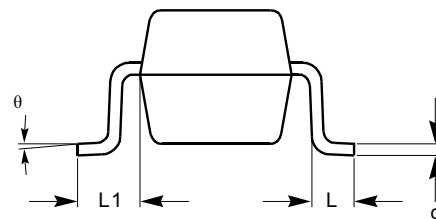


TOP VIEW

Symbol	Min	Nom	Max
A	0.70	1.00	1.15
A1	0.00	---	0.13
b	0.30	0.40	0.50
c	0.08	0.13	0.20
D	2.80	2.90	3.10
E	2.60	2.80	3.00
E1	1.40	1.60	1.80
e	0.95 BSC		
e1	1.90 BSC		
L	0.40 REF		
L1	0.54 REF		
$\theta$	0°	5°	8°



SIDE VIEW



END VIEW

**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Package body sizes exclude mold flash and gate burrs.
- (3) Complies with JEDEC TO-236.

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