



Jan 2011

# MT5060

## N-Channel Power<sup>®</sup> MOSFET

**60 V, 50 A, 12.5 mΩ**

### Features

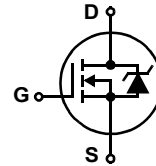
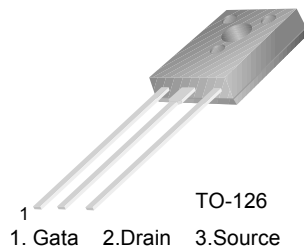
- Max  $r_{DS(on)}$  = 12.5 mΩ at  $V_{GS} = 10$  V,  $I_D = 12$  A
- Max  $r_{DS(on)}$  = 24.5 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 10$  A
- High performance technology for extremely low  $r_{DS(on)}$
- Termination is Lead-free and RoHS Compliant

### General Description

This N-Channel MOSFET is produced using MOS-TECH Semiconductor's advanced Power<sup>®</sup> process that has been especially tailored to minimize the on-state resistance. This device is well suited for Power Management and load switching applications common in Notebook Computers and Portable Battery Packs.

### Applications

- DC/DC Buck Converters
- Notebook battery power management
- Load Switch in Notebook



### MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	60	V
$V_{GS}$	Gate to Source Voltage (Note 4)	$\pm 25$	V
$I_D$	Drain Current -Continuous (Package limited) $T_C = 25^\circ\text{C}$	20	A
	-Continuous (Silicon limited) $T_C = 25^\circ\text{C}$	50	
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	22	
	-Pulsed	90	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	21	mJ
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	25	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2.4	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	5.0	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
MT5060	MT5060	TO-126	-	-	50 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} =$	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^{\circ}\text{C}$		14		mV/ $^{\circ}\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current, Forward	$V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$			100	nA

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$	1.8		3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^{\circ}\text{C}$		-6		mV/ $^{\circ}\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 12\text{ A}$		12.5	15.5	m $\Omega$
		$V_{GS} = 4.5\text{ V}$ , $I_D = 10\text{ A}$		22.3	25	
		$V_{GS} = 10\text{ V}$ , $I_D = 12\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$		15.2	22.1	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}$ , $I_D = 12\text{ A}$		45		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 45\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		1235	1450	pF
$C_{oss}$	Output Capacitance			390	515	pF
$C_{rss}$	Reverse Transfer Capacitance			43	58	pF
$R_g$	Gate Resistance		0.2	1.0	2.0	$\Omega$

**Switching Characteristics**

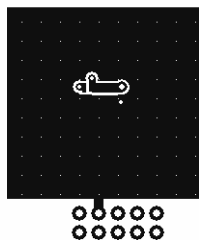
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 45\text{ V}$ , $I_D = 12\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		9	18	ns
$t_r$	Rise Time			2	10	ns
$t_{d(off)}$	Turn-Off Delay Time			19	35	ns
$t_f$	Fall Time			2	10	ns
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V}$ to $10\text{ V}$	$V_{DD} = 15\text{ V}$ , $I_D = 12\text{ A}$	16	26	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V}$ to $5\text{ V}$		8	11	nC
$Q_{gs}$	Gate to Source Charge			3.5		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			1.9		nC

**Drain-Source Diode Characteristics**

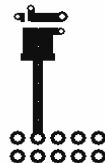
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 1.9\text{ A}$ (Note 2)		0.75	1.2	V
		$V_{GS} = 0\text{ V}$ , $I_S = 12\text{ A}$ (Note 2)		0.80	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 12\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		26	41	ns
$Q_{rr}$	Reverse Recovery Charge			9	18	nC

**Notes:**

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a. 53  $^{\circ}\text{C}/\text{W}$  when mounted on a  
1 in<sup>2</sup> pad of 2 oz copper.



b. 125  $^{\circ}\text{C}/\text{W}$  when mounted on a  
minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.

3.  $E_{AS}$  of 21 mJ is based on starting  $T_J = 25\text{ }^{\circ}\text{C}$ ,  $L = 0.3\text{ mH}$ ,  $I_{AS} = 12\text{ A}$ ,  $V_{DD} = 27\text{ V}$ ,  $V_{GS} = 10\text{ V}$ .

4. As an N-ch device, the negative Vgs rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

# Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

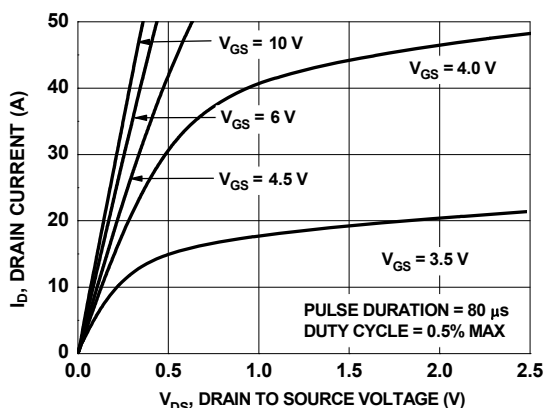


Figure 1. On Region Characteristics

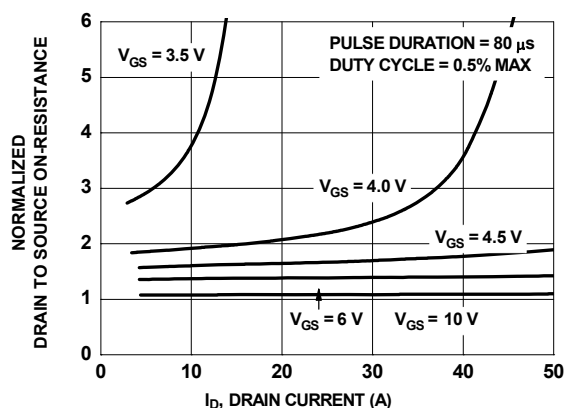


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

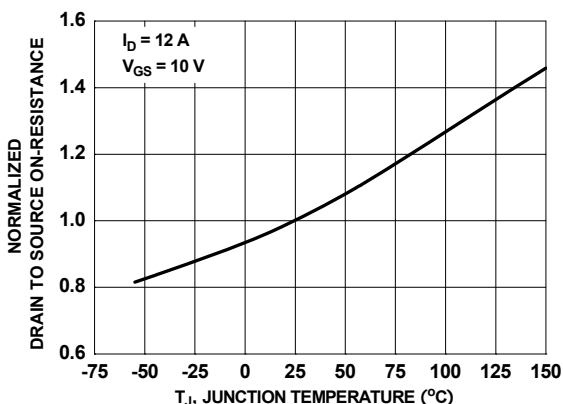


Figure 3. Normalized On Resistance vs Junction Temperature

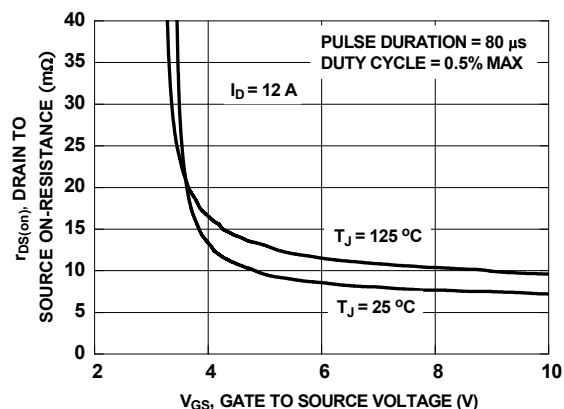


Figure 4. On-Resistance vs Gate to Source Voltage

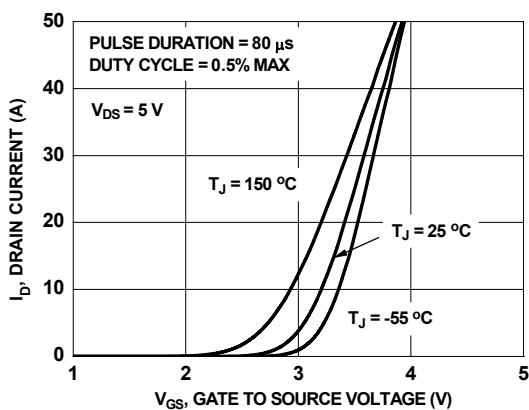


Figure 5. Transfer Characteristics

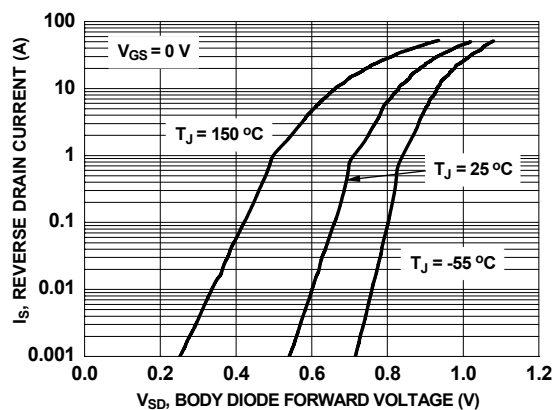


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

# Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

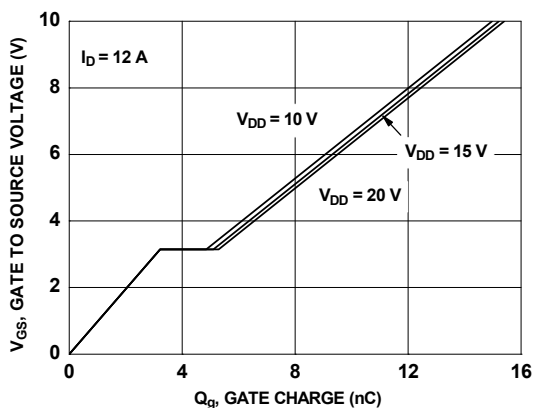


Figure 7. Gate Charge Characteristics

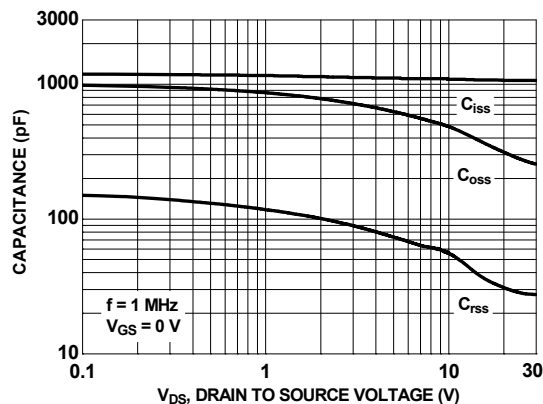


Figure 8. Capacitance vs Drain to Source Voltage

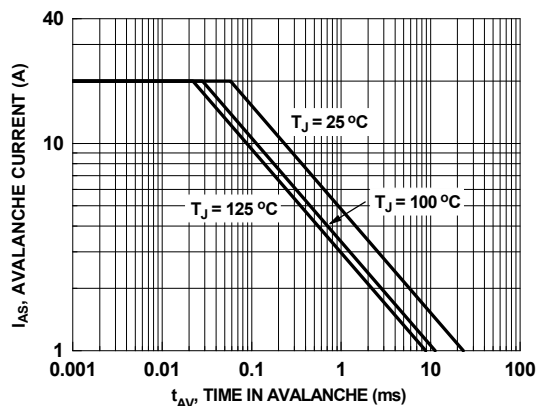


Figure 9. Unclamped Inductive Switching Capability

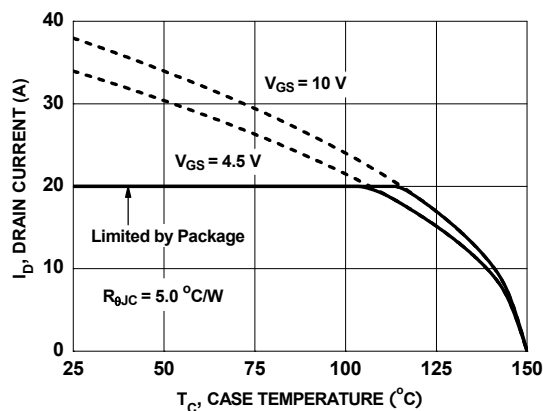


Figure 10. Maximum Continuous Drain Current vs Case Temperature

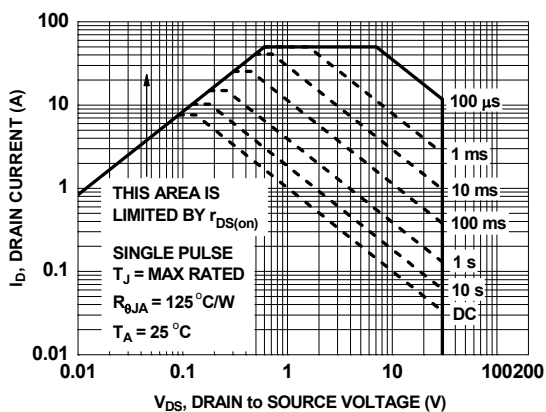


Figure 11. Forward Bias Safe Operating Area

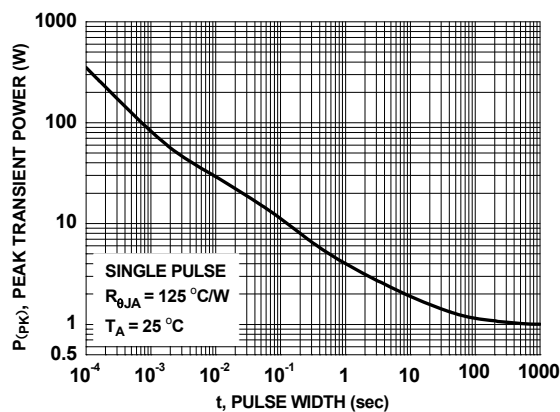


Figure 12. Single Pulse Maximum Power Dissipation

# Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

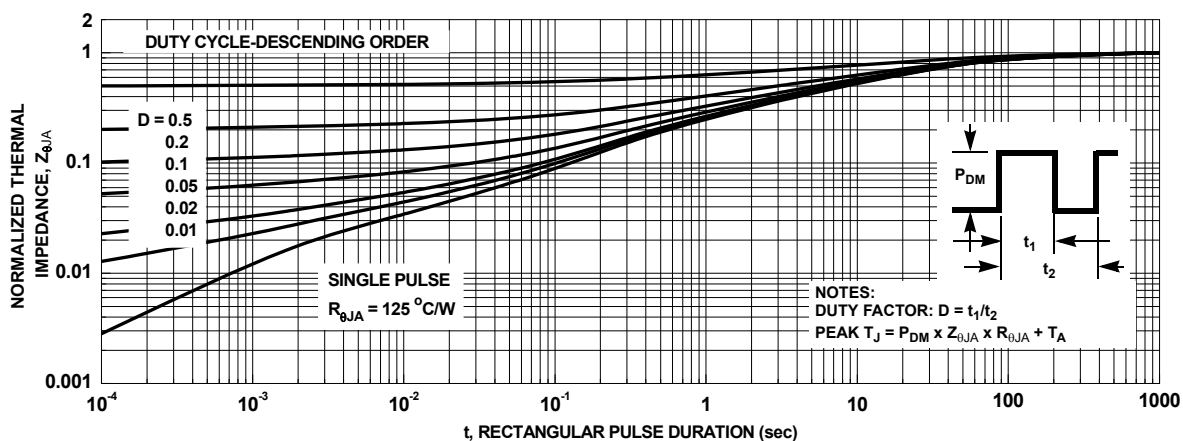
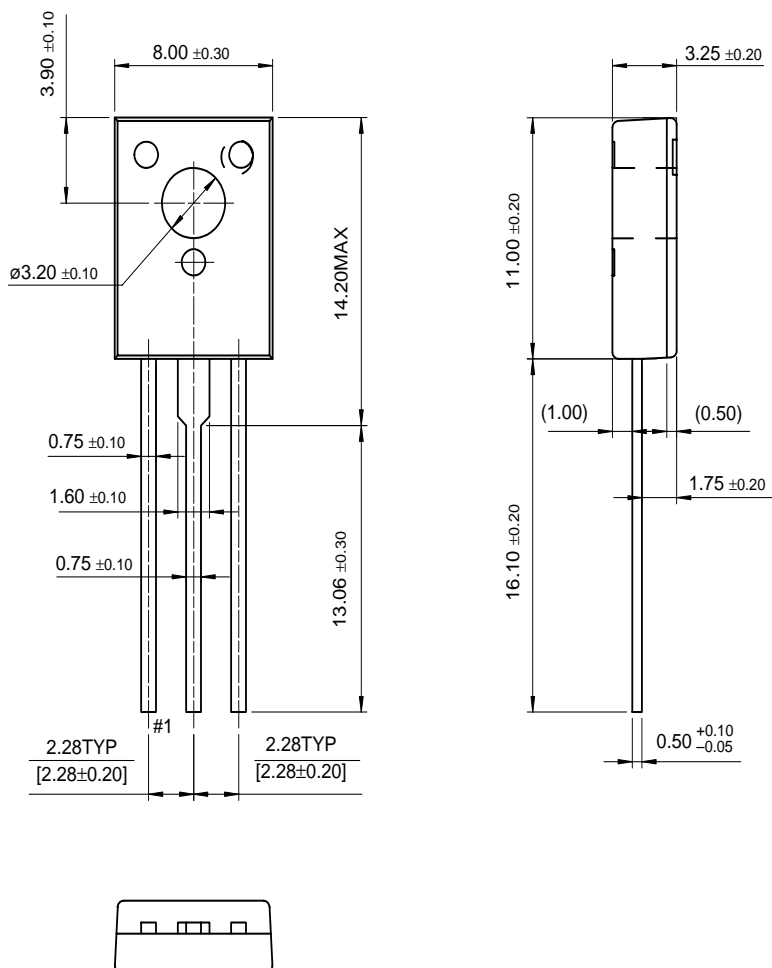


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

# TO-126



Dimensions in Millimeters



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