

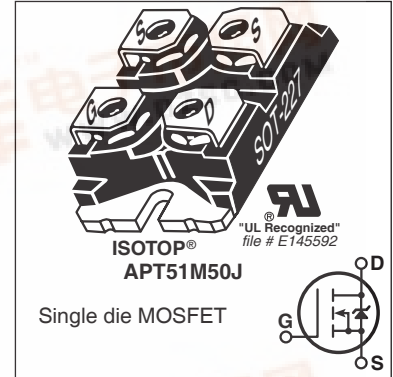


# APT51M50J

500V, 51A, 0.075Ω Max

## N-Channel MOSFET

Power MOS 8™ is a high speed, high voltage N-channel switch-mode power MOSFET. A proprietary planar stripe design yields excellent reliability and manufacturability. Low switching loss is achieved with low input capacitance and ultra low  $C_{rss}$  "Miller" capacitance. The intrinsic gate resistance and capacitance of the poly-silicon gate structure help control slew rates during switching, resulting in low EMI and reliable paralleling, even when switching at very high frequency. Reliability in flyback, boost, forward, and other circuits is enhanced by the high avalanche energy capability.



### FEATURES

- Fast switching with low EMI/RFI
- Low  $R_{DS(on)}$
- Ultra low  $C_{rss}$  for improved noise immunity
- Low gate charge
- Avalanche energy rated
- RoHS compliant

### TYPICAL APPLICATIONS

- PFC and other boost converter
- Buck converter
- Two switch forward (asymmetrical bridge)
- Single switch forward
- Flyback
- Inverters

### Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit
$I_D$	Continuous Drain Current @ $T_C = 25^\circ\text{C}$	51	A
	Continuous Drain Current @ $T_C = 100^\circ\text{C}$	32	
$I_{DM}$	Pulsed Drain Current <sup>①</sup>	230	
$V_{GS}$	Gate-Source Voltage	±30	V
$E_{AS}$	Single Pulse Avalanche Energy <sup>②</sup>	1580	mJ
$I_{AR}$	Avalanche Current, Repetitive or Non-Repetitive	37	A

### Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$			480	W
$R_{\theta JC}$	Junction to Case Thermal Resistance			0.26	$^\circ\text{C/W}$
$R_{\theta CS}$	Case to Sink Thermal Resistance, Flat, Greased Surface		0.15		
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55		150	$^\circ\text{C}$
$V_{Isolation}$	RMS Voltage (50-60Hz Sinusoidal Waveform from Terminals to Mounting Base for 1 Min.)	2500			V
$W_T$	Package Weight		1.03		oz
			29.2		g
Torque	Terminals and Mounting Screws.			10	in-lbf
				1.1	N·m

## Static Characteristics

$T_J = 25^\circ\text{C}$  unless otherwise specified

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Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{BR(DSS)}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	500			V
$\Delta V_{BR(DSS)}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	Reference to $25^\circ\text{C}, I_D = 250\mu A$		0.60		V/ $^\circ\text{C}$
$R_{DS(on)}$	Drain-Source On Resistance <sup>③</sup>	$V_{GS} = 10V, I_D = 37A$		0.064	0.075	$\Omega$
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 2.5mA$	3	4	5	V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold Voltage Temperature Coefficient			-10		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 500V$ $V_{GS} = 0V$			25 500	$\mu A$
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS} = \pm 30V$			$\pm 100$	nA

## Dynamic Characteristics

$T_J = 25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$g_{fs}$	Forward Transconductance	$V_{DS} = 50V, I_D = 37A$		55		S
$C_{iss}$	Input Capacitance	$V_{GS} = 0V, V_{DS} = 25V$ $f = 1MHz$		11600		pF
$C_{rss}$	Reverse Transfer Capacitance			160		
$C_{oss}$	Output Capacitance			1250		
$C_{o(cr)}$ <sup>④</sup>	Effective Output Capacitance, Charge Related	$V_{GS} = 0V, V_{DS} = 0V$ to 333V		725		pF
$C_{o(er)}$ <sup>⑤</sup>	Effective Output Capacitance, Energy Related			365		
$Q_g$	Total Gate Charge	$V_{GS} = 0$ to 10V, $I_D = 37A$ , $V_{DS} = 250V$		290		nC
$Q_{gs}$	Gate-Source Charge			65		
$Q_{gd}$	Gate-Drain Charge			130		
$t_{d(on)}$	Turn-On Delay Time	<b>Resistive Switching</b> $V_{DD} = 333V, I_D = 37A$ $R_G = 2.2\Omega$ <sup>⑥</sup> , $V_{GG} = 15V$		45		ns
$t_r$	Current Rise Time			55		
$t_{d(off)}$	Turn-Off Delay Time			120		
$t_f$	Current Fall Time			39		

## Source-Drain Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$I_S$	Continuous Source Current (Body Diode)	MOSFET symbol showing the integral reverse p-n junction diode (body diode)			51	A
$I_{SM}$	Pulsed Source Current (Body Diode) <sup>①</sup>				230	
$V_{SD}$	Diode Forward Voltage	$I_{SD} = 37A, T_J = 25^\circ\text{C}, V_{GS} = 0V$			1	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 37A$ <sup>②</sup>		695		ns
$Q_{rr}$	Reverse Recovery Charge	$di_{SD}/dt = 100A/\mu s, T_J = 25^\circ\text{C}$		17		$\mu C$
dv/dt	Peak Recovery dv/dt	$I_{SD} \leq 37A, di/dt \leq 1000A/\mu s, V_{DD} = 333V,$ $T_J = 125^\circ\text{C}$			8	V/ns

① Repetitive Rating: Pulse width and case temperature limited by maximum junction temperature.

② Starting at  $T_J = 25^\circ\text{C}$ ,  $L = 2.31mH$ ,  $R_G = 2.2\Omega$ ,  $I_{AS} = 37A$ .

③ Pulse test: Pulse Width < 380 $\mu s$ , duty cycle < 2%.

④  $C_{o(cr)}$  is defined as a fixed capacitance with the same stored charge as  $C_{OSS}$  with  $V_{DS} = 67\%$  of  $V_{(BR)DSS}$ .

⑤  $C_{o(er)}$  is defined as a fixed capacitance with the same stored energy as  $C_{OSS}$  with  $V_{DS} = 67\%$  of  $V_{(BR)DSS}$ . To calculate  $C_{o(er)}$  for any value of  $V_{DS}$  less than  $V_{(BR)DSS}$ , use this equation:  $C_{o(er)} = -1.65E-7/V_{DS}^2 + 5.51E-8/V_{DS} + 2.03E-10$ .

⑥  $R_G$  is external gate resistance, not including internal gate resistance or gate driver impedance. (MIC4452)

Microsemi reserves the right to change, without notice, the specifications and information contained herein.

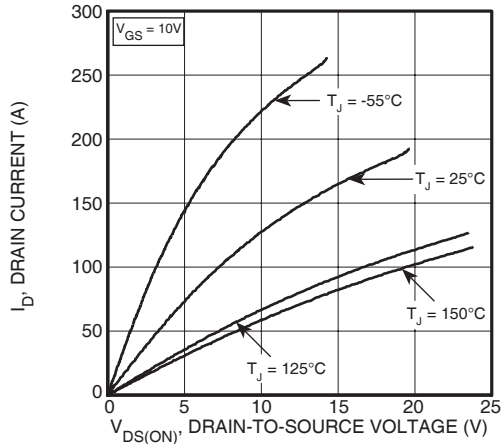


Figure 1, Output Characteristics

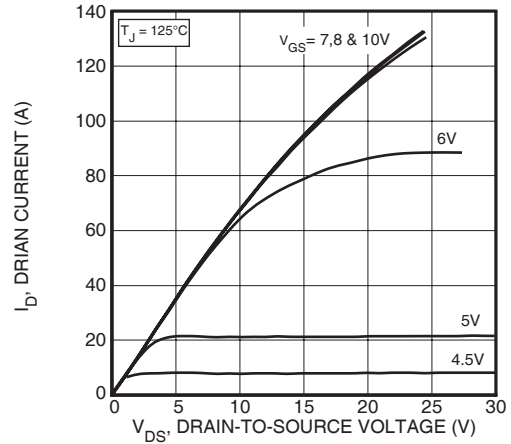


Figure 2, Output Characteristics

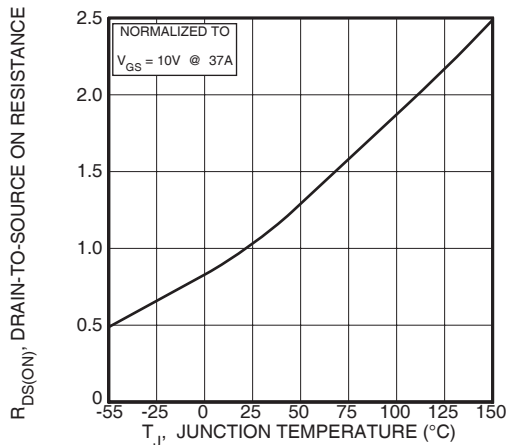


Figure 3,  $R_{DS(ON)}$  vs Junction Temperature

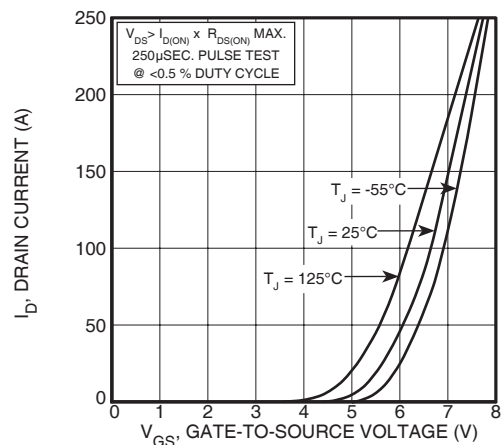


Figure 4, Transfer Characteristics

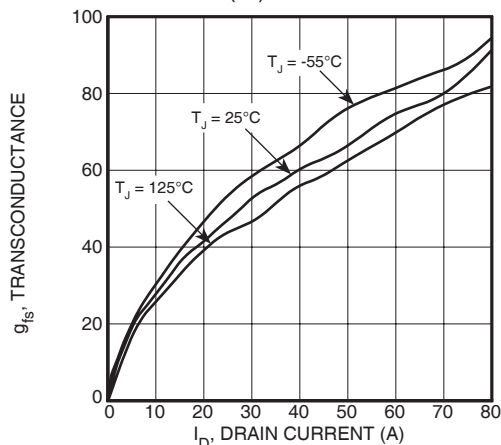


Figure 5, Gain vs Drain Current

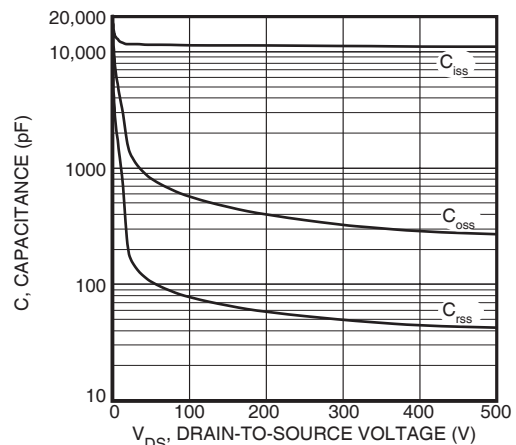


Figure 6, Capacitance vs Drain-to-Source Voltage

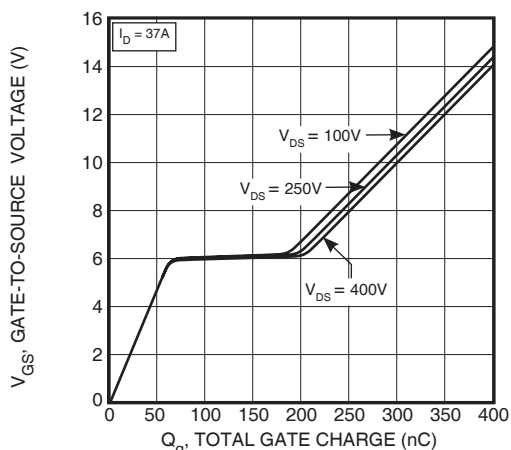


Figure 7, Gate Charge vs Gate-to-Source Voltage

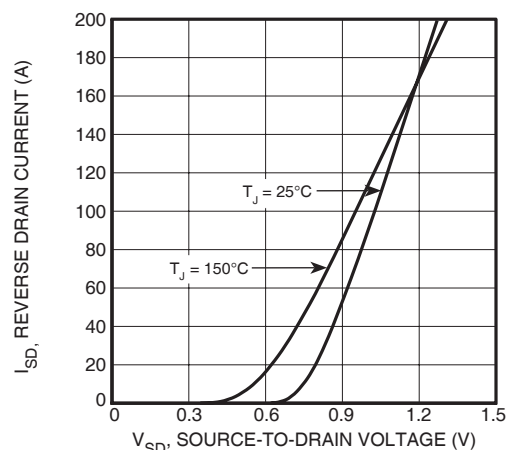


Figure 8, Reverse Drain Current vs Source-to-Drain Voltage

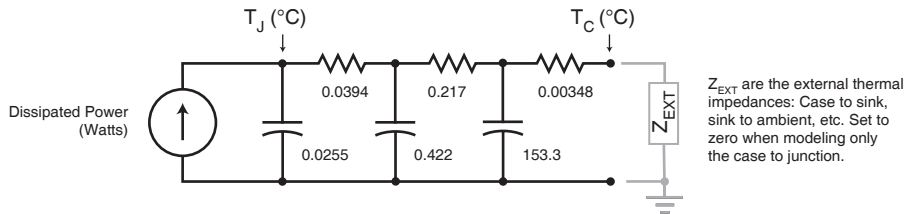
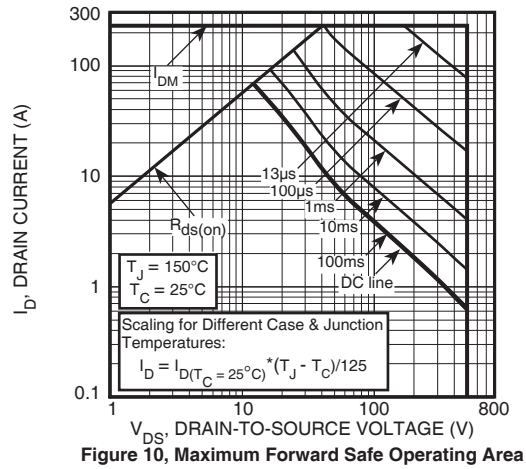
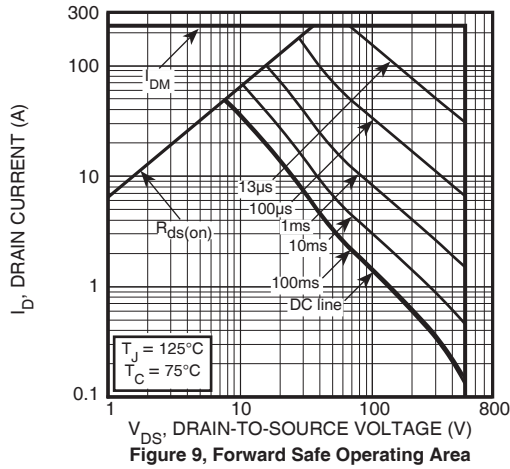


Figure 11, Transient Thermal Impedance Model

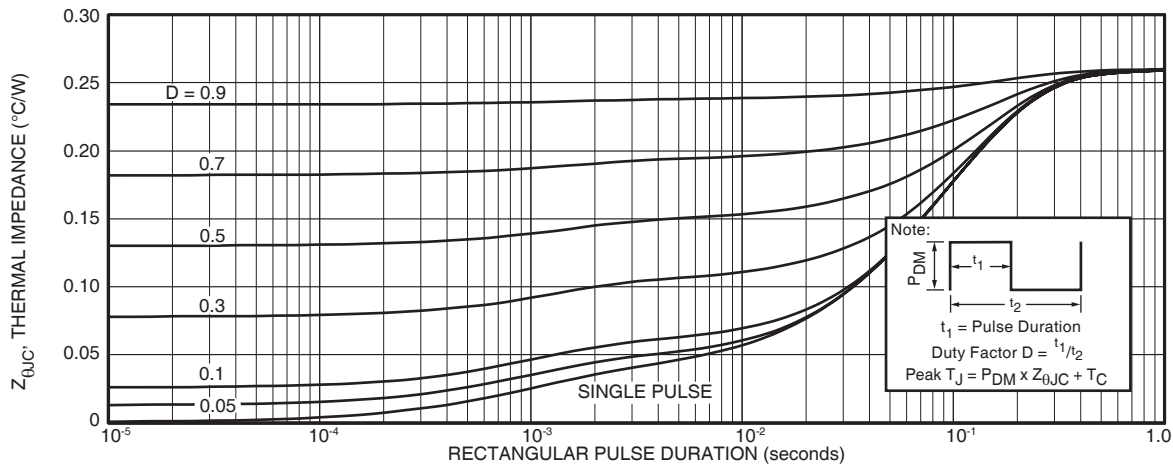
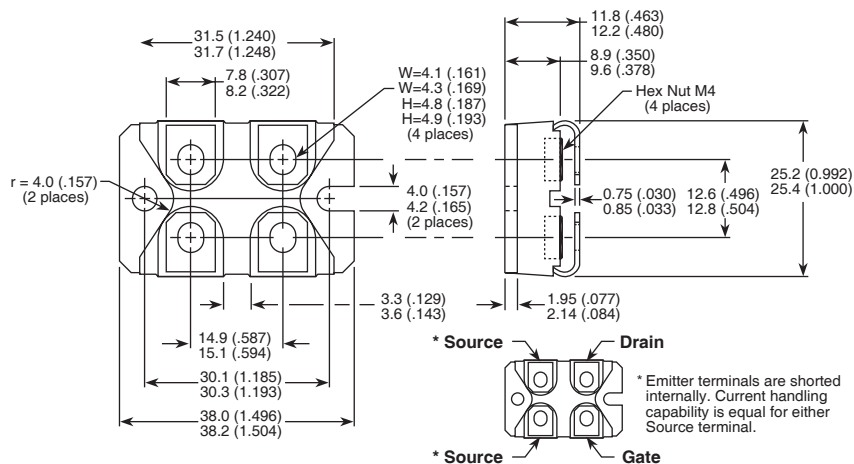


Figure 12. Maximum Effective Transient Thermal Impedance Junction-to-Case vs Pulse Duration

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)