## 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.

T-Max™   TO-264

APT37M100B2   **APT37M100L**

Single die MOSFET
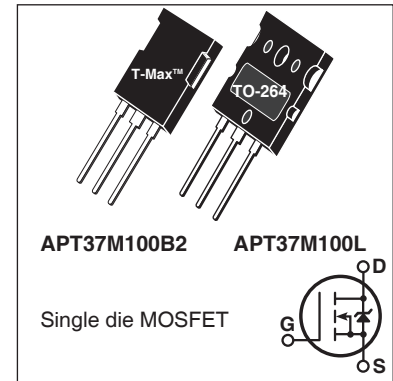
FEATURES

- **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°C	37	A
	Continuous Drain Current @ T_C = 100°C	23	
I_{DM}	Pulsed Drain Current [①]	140	
V_{GS}	Gate-Source Voltage	±30	V
E_{AS}	Single Pulse Avalanche Energy [②]	2165	mJ
I_{AR}	Avalanche Current, Repetitive or Non-Repetitive	18	A

Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
P_D	Total Power Dissipation @ T_C = 25°C			1135	W
$R_{\theta JC}$	Junction to Case Thermal Resistance			0.11	°C/W
$R_{\theta CS}$	Case to Sink Thermal Resistance, Flat, Greased Surface		0.11		
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55		150	°C
T_L	Soldering Temperature for 10 Seconds (1.6mm from case)			300	
W_T	Package Weight		0.22		oz
			6.2		g
Torque	Mounting Torque (TO-264 Package), 4-40 or M3 screw			10	in·lbf
				1.1	N·m

Microsemi Website - http://www.microsemi.com

050-8099   Rev A   12-2006

Static Characteristics $T_J = 25°C$ unless otherwise specified   APT37M100B2_L

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
$V_{BR(DSS)}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V$, $I_D = 250\mu A$		1000			V
$\Delta V_{BR(DSS)}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	Reference to 25°C, $I_D = 250\mu A$			1.15		V/°C
$R_{DS(on)}$	Drain-Source On Resistance ③	$V_{GS} = 10V$, $I_D = 18A$			0.29	0.33	Ω
$V_{GS(th)}$	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/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 1000V$	$T_J = 25°C$			100	μA
		$V_{GS} = 0V$	$T_J = 125°C$			500	
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = \pm30V$				±100	nA

Dynamic Characteristics $T_J = 25°C$ unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
g_{fs}	Forward Transconductance	$V_{DS} = 50V$, $I_D = 18A$		39		S
C_{iss}	Input Capacitance	$V_{GS} = 0V$, $V_{DS} = 25V$ f = 1MHz		9835		pF
C_{rss}	Reverse Transfer Capacitance			130		
C_{oss}	Output Capacitance			825		
$C_{o(cr)}$ ④	Effective Output Capacitance, Charge Related	$V_{GS} = 0V$, $V_{DS} = 0V$ to 667V		335		
$C_{o(er)}$ ⑤	Effective Output Capacitance, Energy Related			170		
Q_g	Total Gate Charge	$V_{GS} = 0$ to 10V, $I_D = 18A$, $V_{DS} = 500V$		305		nC
Q_{gs}	Gate-Source Charge			55		
Q_{gd}	Gate-Drain Charge			145		
$t_{d(on)}$	Turn-On Delay Time	**Resistive Switching** $V_{DD} = 667V$, $I_D = 18A$ $R_G = 2.2\Omega$⑥, $V_{GG} = 15V$		44		ns
t_r	Current Rise Time			40		
$t_{d(off)}$	Turn-Off Delay Time			150		
t_f	Current Fall Time			38		

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)			37	A
I_{SM}	Pulsed Source Current (Body Diode) ①				140	
V_{SD}	Diode Forward Voltage	$I_{SD} = 18A$, $T_J = 25°C$, $V_{GS} = 0V$			1	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 18A$ ③		1165		ns
Q_{rr}	Reverse Recovery Charge	$di_{SD}/dt = 100A/\mu s$, $T_J = 25°C$		33		μC
dv/dt	Peak Recovery dv/dt	$I_{SD} \leq 18A$, di/dt $\leq 1000A/\mu s$, $V_{DD} = 100V$, $T_J = 125°C$			10	V/ns

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

② Starting at $T_J = 25°C$, L = 13.36mH, $R_G = 2.2\Omega$, $I_{AS} = 18A$.

③ Pulse test: Pulse Width < 380µs, 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: $C_{o(er)} = -2.85E-7/V_{DS}^2 + 5.04E-8/V_{DS} + 9.75E-11$.

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.
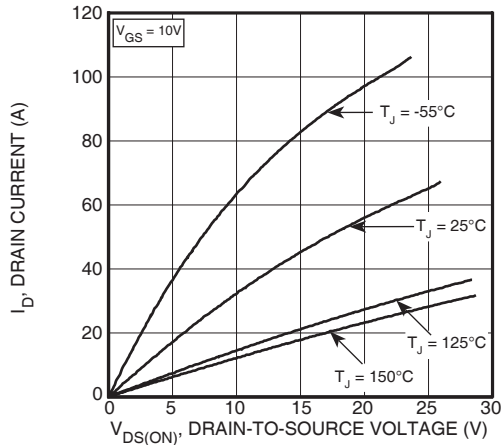
V_{GS} = 10V

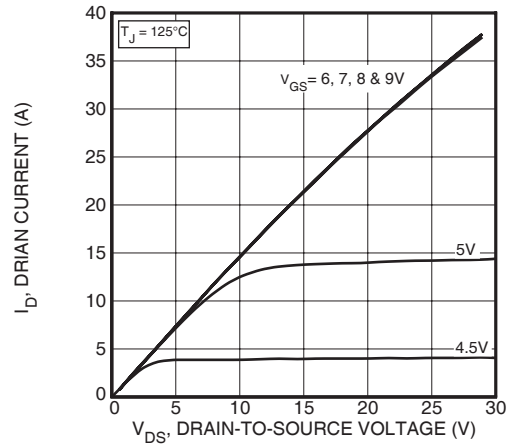I_D, DRAIN CURRENT (A)

T_J = -55°C

T_J = 25°C

T_J = 125°C

T_J = 150°C

$V_{DS(ON)}$, DRAIN-TO-SOURCE VOLTAGE (V)

Figure 1, Output Characteristics

T_J = 125°C

I_D, DRIAN CURRENT (A)

V_{GS}= 6, 7, 8 & 9V

5V

4.5V

V_{DS}, DRAIN-TO-SOURCE VOLTAGE (V)

Figure 2, Output Characteristics

NORMALIZED TO
V_{GS} = 10V @ 18A

$R_{DS(ON)}$, DRAIN-TO-SOURCE ON RESISTANCE

T_J, JUNCTION TEMPERATURE (°C)
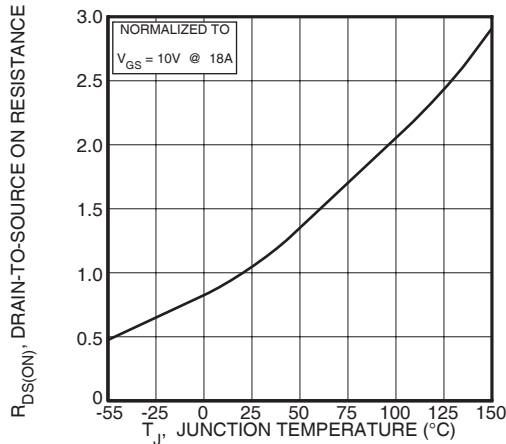
Figure 3, $R_{DS(ON)}$ vs Junction Temperature

V_{DS}> $I_{D(ON)}$ x $R_{DS(ON)}$ MAX.
250µSEC. PULSE TEST
@ <0.5 % DUTY CYCLE

I_D, DRAIN CURRENT (A)

T_J = -55°C

T_J = 25°C

T_J = 125°C

V_{GS}, GATE-TO-SOURCE VOLTAGE (V)
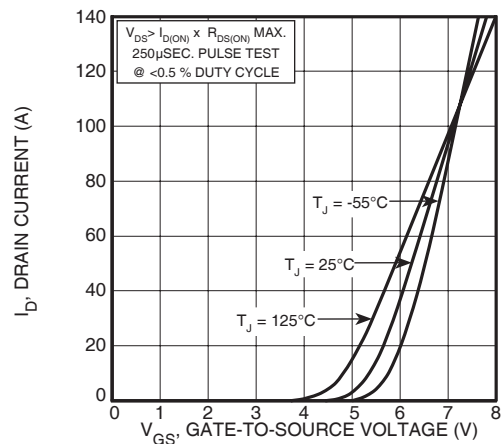
Figure 4, Transfer Characteristics

g_{fs}, TRANSCONDUCTANCE

T_J = -55°C

T_J = 25°C

T_J = 125°C
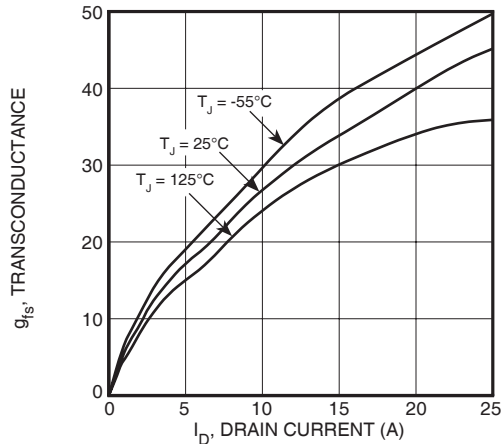
I_D, DRAIN CURRENT (A)

Figure 5, Gain vs Drain Current

C_{iss}

C, CAPACITANCE (pF)

C_{oss}

C_{rss}

V_{DS}, DRAIN-TO-SOURCE VOLTAGE (V)
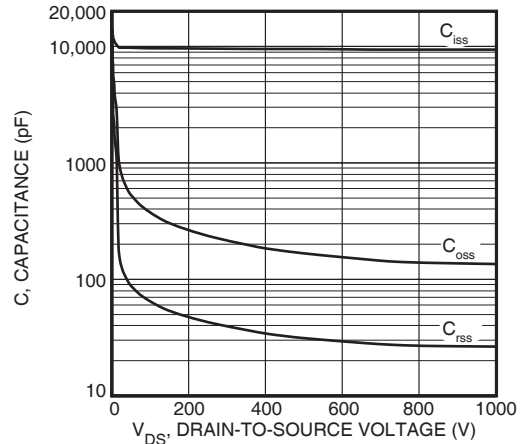
Figure 6, Capacitance vs Drain-to-Source Voltage

I_D = 18A

V_{GS}, GATE-TO-SOURCE VOLTAGE (V)

V_{DS} = 200V

V_{DS} = 500V

V_{DS} = 800V

Q_g, TOTAL GATE CHARGE (nC)
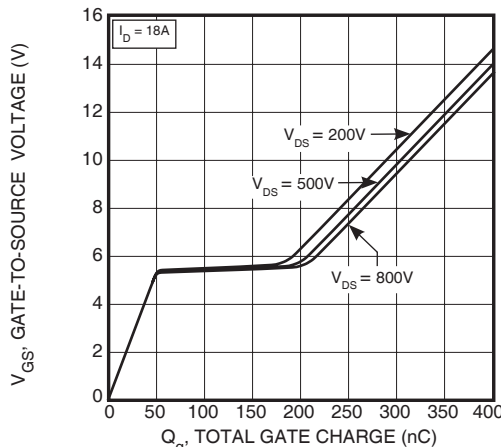
Figure 7, Gate Charge vs Gate-to-Source Voltage

I_{SD}, REVERSE DRAIN CURRENT (A)

T_J = 25°C

T_J = 150°C

V_{SD}, SOURCE-TO-DRAIN VOLTAGE (V)
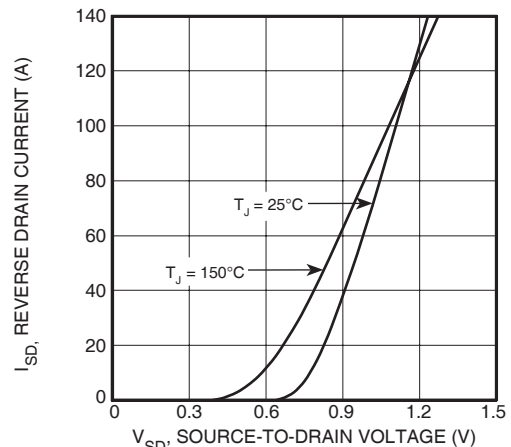
Figure 8, Reverse Drain Current vs Source-to-Drain Voltage

I_DM

R_ds(on)

13µs
100µs
1ms
10ms
100ms
DC line

$T_J = 125°C$
$T_C = 75°C$

V_{DS}, DRAIN-TO-SOURCE VOLTAGE (V)

I_D, DRAIN CURRENT (A)
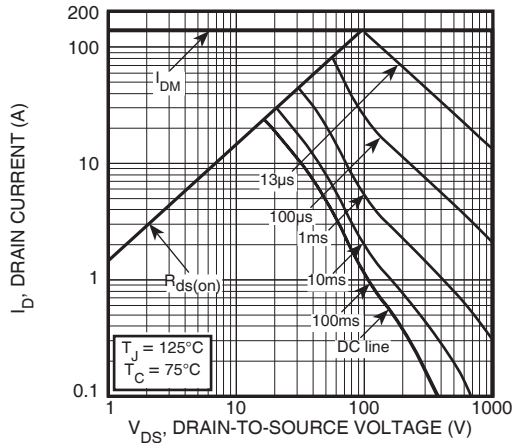
Figure 9, Forward Safe Operating Area

I_DM

R_ds(on)

13µs
100µs
1ms
10ms
100ms
DC line

$T_J = 150°C$
$T_C = 25°C$

Scaling for Different Case & Junction Temperatures:

$I_D = I_{D(T_C = 25°C)} * (T_J - T_C)/125$

V_{DS}, DRAIN-TO-SOURCE VOLTAGE (V)

I_D, DRAIN CURRENT (A)
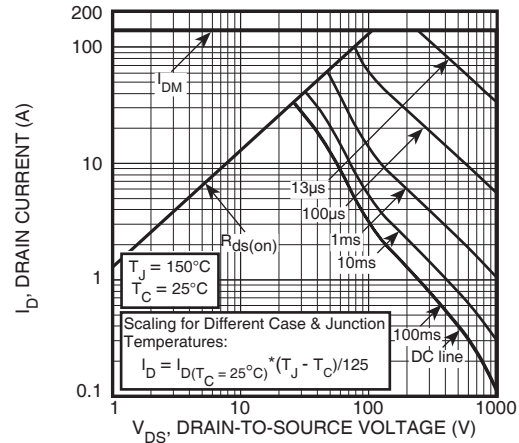
Figure 10, Maximum Forward Safe Operating Area

T_J (°C)

T_C (°C)

Dissipated Power (Watts)

0.0167   0.0401   0.0525

0.0147   0.0330   0.479

Z_{EXT}

Z_{EXT} are the external thermal impedances: Case to sink, sink to ambient, etc. Set to zero when modeling only the case to junction.
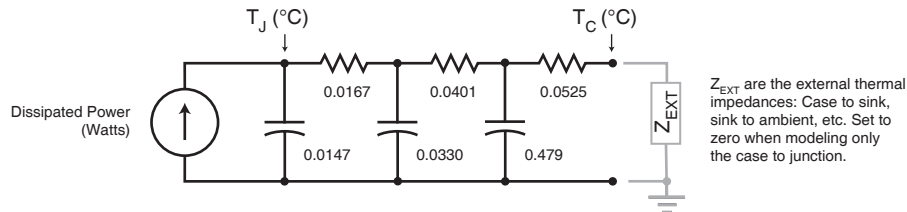
Figure 11, Transient Thermal Impedance Model

$Z_{\theta JC}$, THERMAL IMPEDANCE (°C/W)

D = 0.9
0.7
0.5
0.3
0.1
0.05

SINGLE PULSE

Note:

P_{DM}

t_1

t_2

t_1 = Pulse Duration

Duty Factor D = t_1/t_2

Peak $T_J = P_{DM} \times Z_{\theta JC} + T_C$

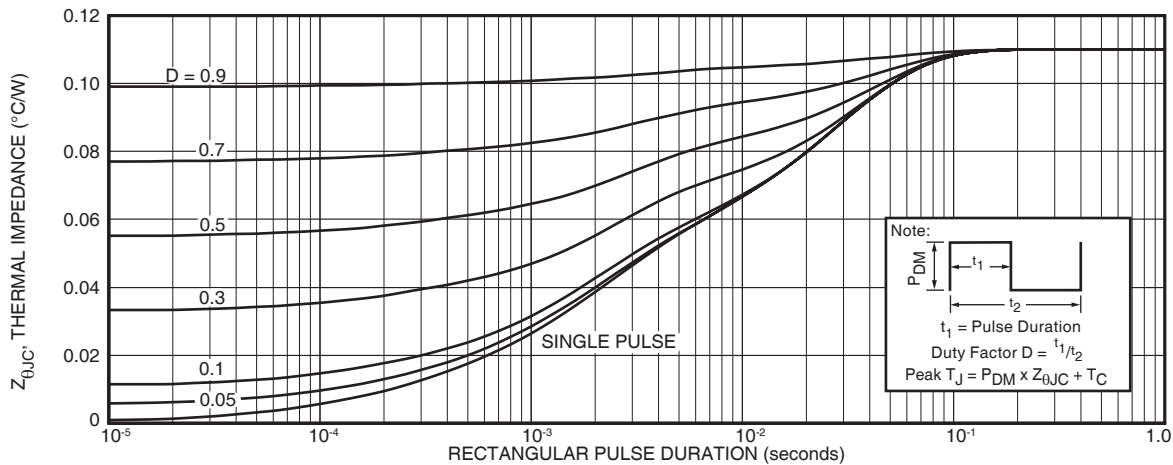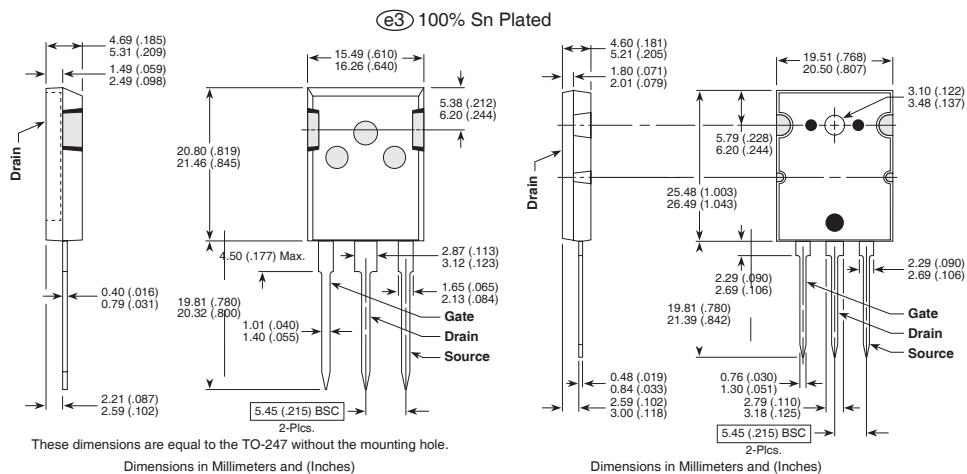RECTANGULAR PULSE DURATION (seconds)

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

T-MAX® (B2) Package Outline

TO-264 (L) Package Outline

(e3) 100% Sn Plated

Drain

4.69 (.185)
5.31 (.209)

1.49 (.059)
2.49 (.098)

15.49 (.610)
16.26 (.640)

5.38 (.212)
6.20 (.244)

20.80 (.819)
21.46 (.845)

4.50 (.177) Max.

0.40 (.016)
0.79 (.031)

19.81 (.780)
20.32 (.800)

1.01 (.040)
1.40 (.055)

2.87 (.113)
3.12 (.123)

1.65 (.065)
2.13 (.084)

Gate
Drain
Source

2.21 (.087)
2.59 (.102)

5.45 (.215) BSC
2-Plcs.

These dimensions are equal to the TO-247 without the mounting hole.

Dimensions in Millimeters and (Inches)

Drain

4.60 (.181)
5.21 (.205)

1.80 (.071)
2.01 (.079)

19.51 (.768)
20.50 (.807)

3.10 (.122)
3.48 (.137)

5.79 (.228)
6.20 (.244)

25.48 (1.003)
26.49 (1.043)

2.29 (.090)
2.69 (.106)

19.81 (.780)
21.39 (.842)

0.48 (.019)
0.84 (.033)

0.76 (.030)
1.30 (.051)

2.79 (.110)
3.18 (.125)

2.29 (.090)
2.69 (.106)

Gate
Drain
Source

2.59 (.102)
3.00 (.118)

5.45 (.215) BSC
2-Plcs.

Dimensions in Millimeters and (Inches)