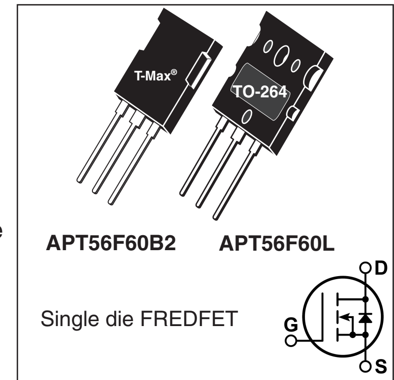
APT56F60B2
APT56F60L

600V, 60A, 0.11Ω Max, t_{rr} ≤290ns

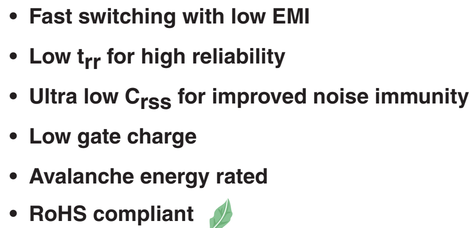
N-Channel FREDFET

Power MOS 8™ is a high speed, high voltage N-channel switch-mode power MOSFET. This 'FREDFET' version has a drain-source (body) diode that has been optimized for high reliability in ZVS phase shifted bridge and other circuits through reduced t_{rr}, soft recovery, and high recovery dv/dt capability. Low gate charge, high gain, and a greatly reduced ratio of C_{rss}/C_{iss} result in excellent noise immunity and low switching loss. The intrinsic gate resistance and capacitance of the poly-silicon gate structure help control di/dt during switching, resulting in low EMI and reliable paralleling, even when switching at very high frequency.



FEATURES

- Fast switching with low EMI
- Low t_{rr} for high reliability
- Ultra low C_{rss} for improved noise immunity
- Low gate charge
- Avalanche energy rated
- RoHS compliant



TYPICAL APPLICATIONS

- ZVS phase shifted and other full bridge
- Half bridge
- PFC and other boost converter
- Buck converter
- Single and two switch forward
- Flyback

Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit
I_D	Continuous Drain Current @ T_C = 25°C	60	A
	Continuous Drain Current @ T_C = 100°C	38	
I_{DM}	Pulsed Drain Current ①	210	
V_{GS}	Gate-Source Voltage	±30	V
E_{AS}	Single Pulse Avalanche Energy ②	1580	mJ
I_{AR}	Avalanche Current, Repetitive or Non-Repetitive	28	A

Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
P_D	Total Power Dissipation @ T_C = 25°C			1040	W
$R_{\theta JC}$	Junction to Case Thermal Resistance			0.12	°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

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Static Characteristics $T_J = 25°C$ unless otherwise specified APT56F60B2_L

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
$V_{BR(DSS)}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V$, $I_D = 250\mu A$		600			V
$\Delta V_{BR(DSS)}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	Reference to 25°C, $I_D = 250\mu A$			0.57		V/°C
$R_{DS(on)}$	Drain-Source On Resistance ③	$V_{GS} = 10V$, $I_D = 28A$			0.09	0.11	Ω
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 2.5mA$		2.5	4	5	V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold Voltage Temperature Coefficient				-10		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600V$	$T_J = 25°C$			250	μA
		$V_{GS} = 0V$	$T_J = 125°C$			1000	
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = \pm 30V$				±100	nA

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
g_{fs}	Forward Transconductance	$V_{DS} = 50V$, $I_D = 28A$		55		S
C_{iss}	Input Capacitance	$V_{GS} = 0V$, $V_{DS} = 25V$ f = 1MHz		11300		pF
C_{rss}	Reverse Transfer Capacitance			115		
C_{oss}	Output Capacitance			1040		
$C_{o(cr)}$ ④	Effective Output Capacitance, Charge Related	$V_{GS} = 0V$, $V_{DS} = 0V$ to 400V		550		
$C_{o(er)}$ ⑤	Effective Output Capacitance, Energy Related			285		
Q_g	Total Gate Charge	$V_{GS} = 0$ to 10V, $I_D = 28A$, $V_{DS} = 300V$		280		nC
Q_{gs}	Gate-Source Charge			60		
Q_{gd}	Gate-Drain Charge			120		
$t_{d(on)}$	Turn-On Delay Time	**Resistive Switching** $V_{DD} = 400V$, $I_D = 28A$ $R_G = 2.2\Omega$ ⑥, $V_{GG} = 15V$		65		ns
t_r	Current Rise Time			75		
$t_{d(off)}$	Turn-Off Delay Time			190		
t_f	Current Fall Time			60		

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)				60	A
I_{SM}	Pulsed Source Current (Body Diode) ①					210	
V_{SD}	Diode Forward Voltage	$I_{SD} = 28A$, $T_J = 25°C$, $V_{GS} = 0V$				1.2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 28A$ ③ $di_{SD}/dt = 100A/\mu s$ $V_{DD} = 100V$	$T_J = 25°C$		255	290	ns
			$T_J = 125°C$		450	540	
Q_{rr}	Reverse Recovery Charge		$T_J = 25°C$		1.41		μC
			$T_J = 125°C$		3.66		
I_{rrm}	Reverse Recovery Current		$T_J = 25°C$		10.7		A
			$T_J = 125°C$		15.8		
dv/dt	Peak Recovery dv/dt	$I_{SD} \le 28A$, $di/dt \le 1000A/\mu s$, $V_{DD} = 400V$, $T_J = 125°C$				20	V/ns

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

② Starting at $T_J = 25°C$, L = 4.03mH, $R_G = 25\Omega$, $I_{AS} = 28A$.

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: $C_{o(er)} = -1.10E{-7}/V_{DS}{}^2 + 4.60E{-8}/V_{DS} + 1.72E{-10}$.

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.

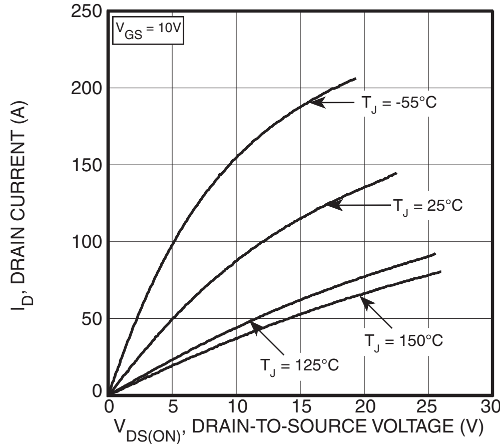


Figure 1, Output Characteristics

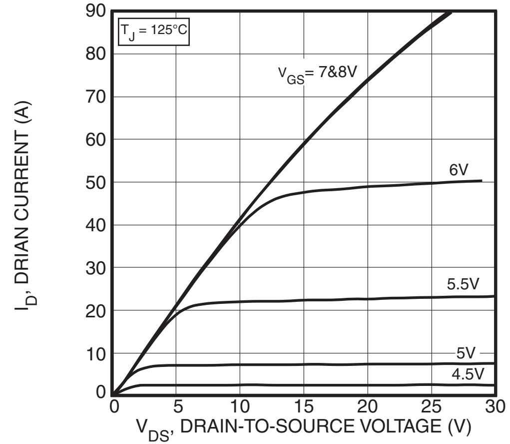


Figure 2, Output Characteristics

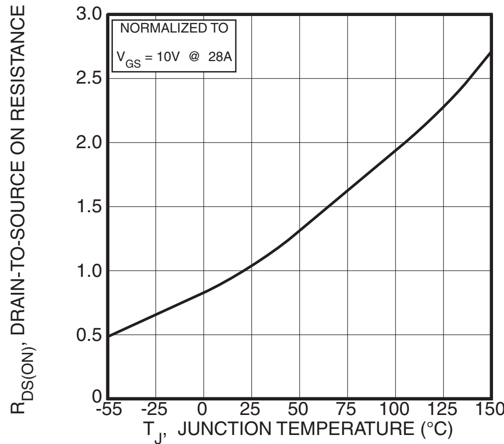


Figure 3, $R_{DS(ON)}$ vs Junction Temperature

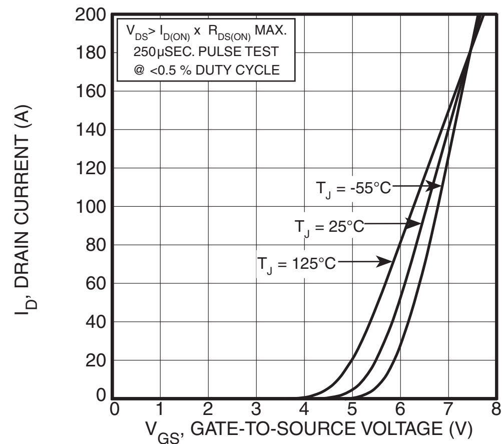


Figure 4, Transfer Characteristics

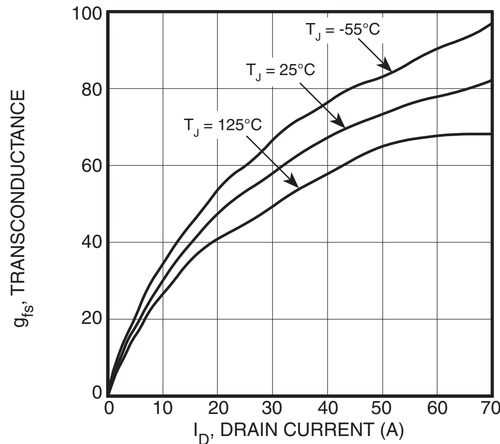


Figure 5, Gain vs Drain Current

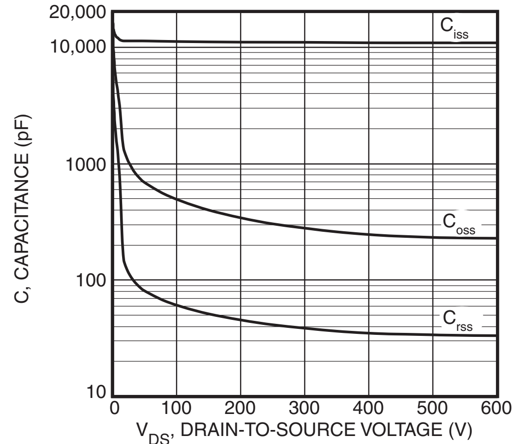


Figure 6, Capacitance vs Drain-to-Source Voltage

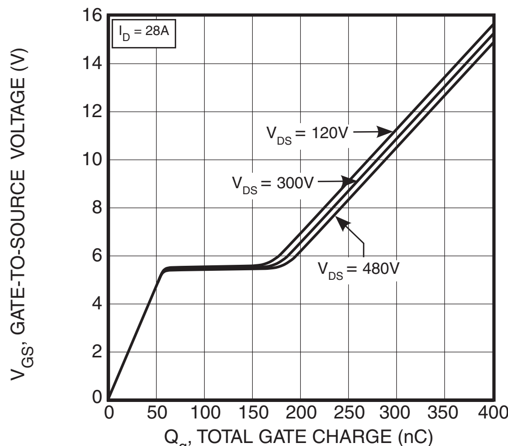


Figure 7, Gate Charge vs Gate-to-Source Voltage

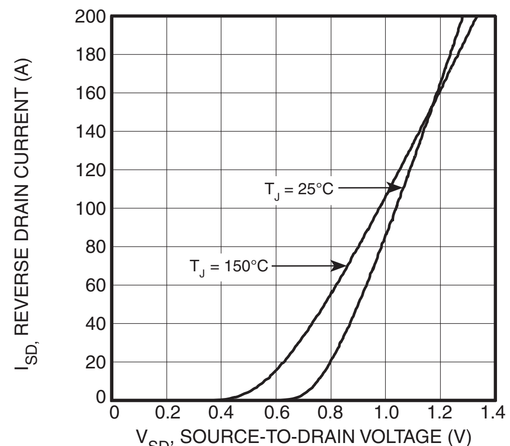


Figure 8, Reverse Drain Current vs Source-to-Drain Voltage

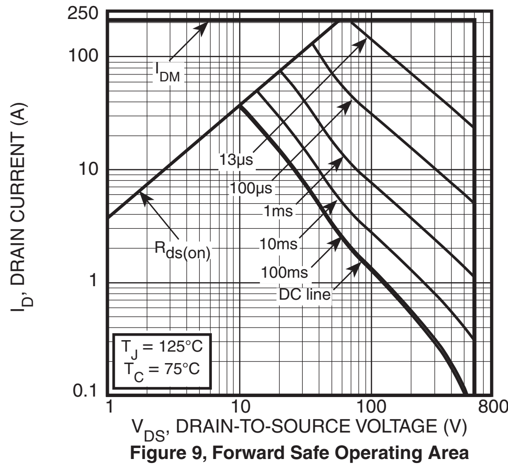


Figure 9, Forward Safe Operating Area

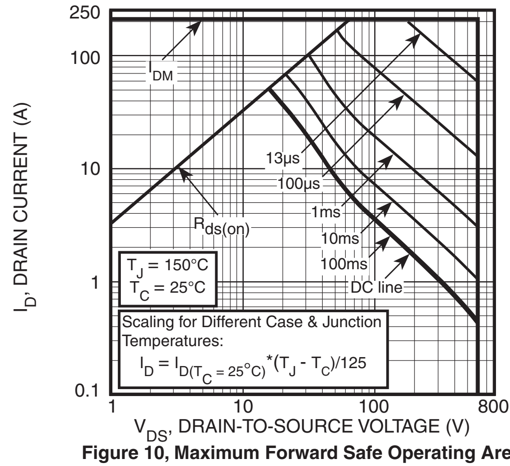


Figure 10, Maximum Forward Safe Operating Area

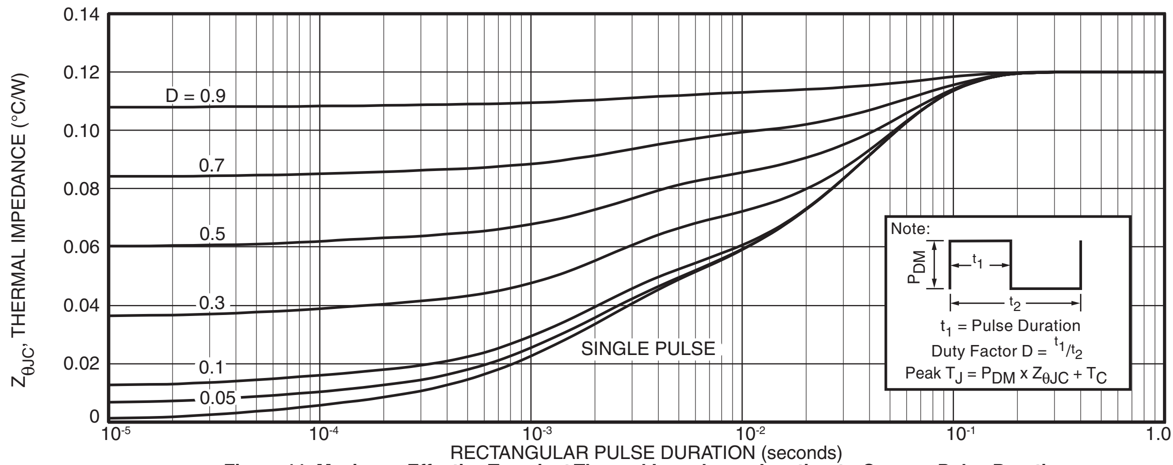
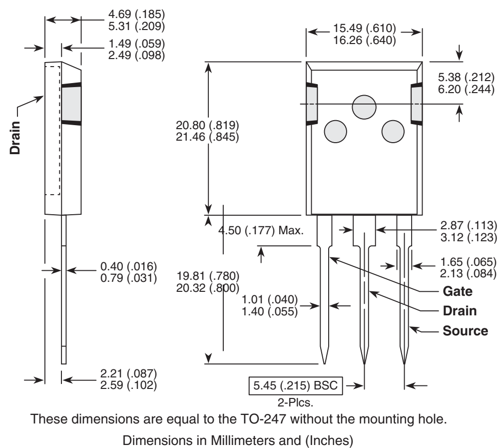


Figure 11. Maximum Effective Transient Thermal Impedance Junction-to-Case vs Pulse Duration

T-MAX® (B2) Package Outline

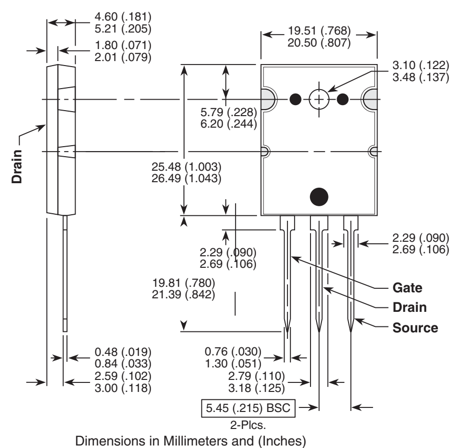
TO-264 (L) Package Outline

e3 100% Sn Plated



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

Dimensions in Millimeters and (Inches)



Dimensions in Millimeters and (Inches)

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