

## P-Channel 20V (D-S) MOSFET With Schottky Diode

### 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.

### Features

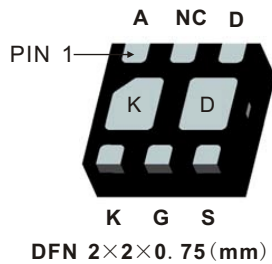
- MOSFET
- $V_{DS} (V) = -20V$
  - $I_D(A) = -3.9A$  ( $V_{GS} = -4.5V$ )
  - $R_{DS(on)} = 110 m\Omega @ V_{GS} = -4.5V$
  - $R_{DS(on)} = 145 m\Omega @ V_{GS} = -2.5V$
  - $R_{DS(on)} = 175 m\Omega @ V_{GS} = -1.8V$

### Applications

Charging Switch For Portable Devices

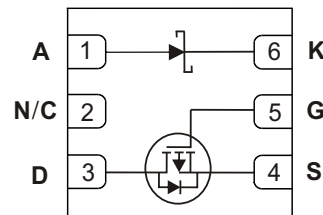
### Schottky Diode

- $V_R (V) = 20V$
- $I_F(A) = 2.0A$
- $V_F(TYP) = 0.41 V @ 0.5A$



### Schottky Diode

### P-channel Mosfet



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

Parameter	Value	Units	
Drain-Source Voltage (MOSFET)	-20	V	
Reverse Voltage (Schottky)	20		
Gate-Source Voltage (MOSFET)	$\pm 8$		
Continuous Drain Current ( $T_J = 150^\circ C$ ) (MOSFET) <sup>a</sup>	$T_A = 25^\circ C$	A	
	$T_A = 70^\circ C$		-3.1
Pulsed Drain Current (MOSFET)	-16	A	
Continuous Source Current (MOSFET Diode Conduction) <sup>a</sup>	-1.25		
Average Forward Current (Schottky) <sup>a</sup>	2.0		
Pulsed Forward Current (Schottky) <sup>a</sup>	8.0	W	
Maximum Power Dissipation (MOSFET) <sup>a</sup> Power dissipation for single operation	$T_A = 25^\circ C$		2.3
	$T_A = 70^\circ C$		1.5
Maximum Power Dissipation (Schottky) <sup>a</sup> Power dissipation for single operation	$T_A = 25^\circ C$		2.1
	$T_A = 70^\circ C$	1.3	
Operating Junction and Storage Temperature Range	-55 to 150	$^\circ C$	
Soldering Recommendations (Peak Temperature) <sup>b, c</sup>	260		

#### Notes

a. Surface Mounted on 1" x 1" FR4 Board.

b. The DFN is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the regulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.

c. Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.



**Package Outlines and Ordering Information**

Device	Device Marking	Reel Size	Tape Width	Quantity
MC3117	D401 .XXXX	7"	8mm	3000 units

**Thermal Resistance Ratings**

Parameter	Device	Symbol	Typical	Maximum	Units
Junction-to-Ambient <sup>a</sup>	T ≤ 10 sec	MOSFET	45	55	°C/W
		Schottky	50	60	
	Steady State	MOSFET	80	100	
		Schottky	85	110	
Junction-to-Foot	Steady State	MOSFET	10	12	
		Schottky	13	16	

**MOSFET Specifications (T<sub>J</sub>=25°C Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
<b>Static</b>						
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA	-20			V
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250uA	-0.45		-0.9	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0V, V <sub>GS</sub> = ±8V			±100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = -16V, V <sub>GS</sub> = 0 V			-1.0	uA
		V <sub>DS</sub> = -16V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 55°C			-10	
On-State Drain Current <sup>d</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = -5V, V <sub>GS</sub> = -4.5 V	-18			A
Drain-Source On-State Resistance <sup>d</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3.9 A		100	110	mΩ
		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -2.0 A		130	145	
		V <sub>GS</sub> = -1.8V, I <sub>D</sub> = -1.0 A		160	175	
Forward Transconductance <sup>d</sup>	g <sub>fs</sub>	V <sub>DS</sub> = -5V, I <sub>D</sub> = -3.9 A		15		S
Diode Forward Voltage <sup>d</sup>	V <sub>SD</sub>	I <sub>S</sub> = -1.0A, V <sub>GS</sub> = 0 V			-1.2	V

**Dynamic <sup>e</sup>**

Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = -10V, V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3.9 A		6.0		nC
Gate-Source Charge	Q <sub>gs</sub>			0.8		
Gate-Drain Charge	Q <sub>gd</sub>			1.3		
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = -10V, R <sub>G</sub> = 6 ohm I <sub>D</sub> = -1A, V <sub>GEN</sub> = -4.5 V		6.5	25	ns
Rise Time	t <sub>r</sub>			20	60	
Turn-Off Delay Time	t <sub>d(off)</sub>			31	70	
Fall Time	t <sub>f</sub>			21	60	
Source-Drain Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = -0.9 A, di/dt = 100 A/S		20	40	

Notes

d.Pulse test; pulse width ≤ 300us, duty cycle ≤ 2%.

e.Guaranteed by design, not subject to production testing.

**SCHOTTKY Specifications (T<sub>J</sub>=25°C Unless Otherwise Noted)**

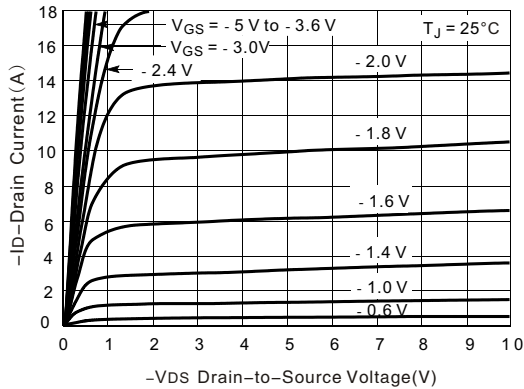
Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Forward Voltage Drop	V <sub>F</sub>	I <sub>F</sub> = 0.1 A		220	320	mV
		I <sub>F</sub> = 0.5 A		410	430	
Reverse Breakdown Voltage	V <sub>BR</sub>	I <sub>r</sub> = 0.25mA	23			V
Maximum Reverse Leakage Current	I <sub>R</sub>	V <sub>r</sub> = 10 V			10	uA
		V <sub>r</sub> = 20 V			50	
Junction Capacitance	C <sub>T</sub>	V <sub>r</sub> = 10 V		31		pF



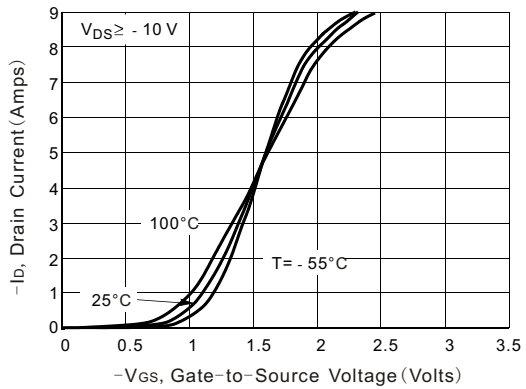
**Typical Electrical and Thermal Characteristics**

**Typical P-Channel Performance Curves**

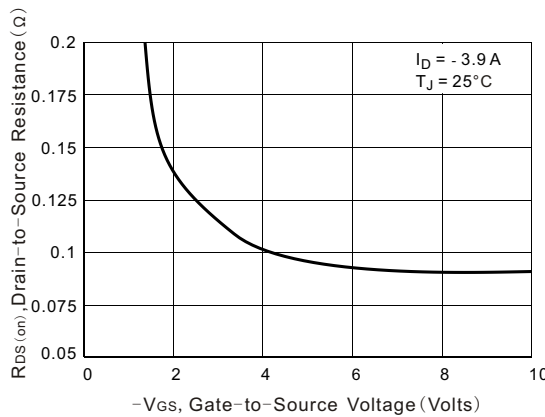
(T<sub>J</sub> = 25°C unless otherwise noted)



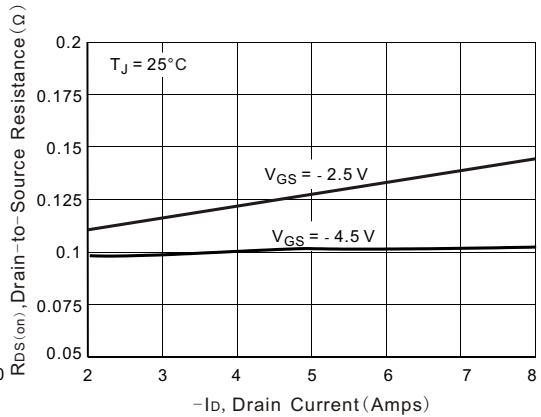
**Figure 1. On-Region Characteristics**



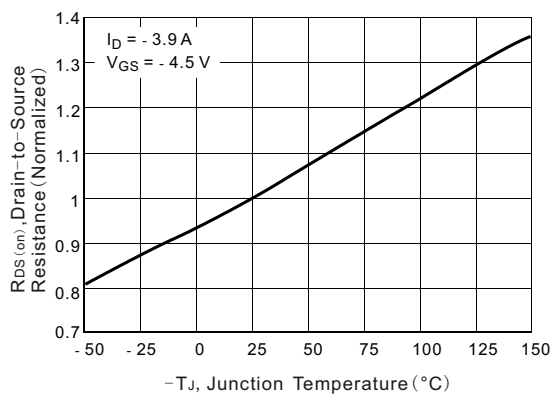
**Figure 2. Transfer Characteristics**



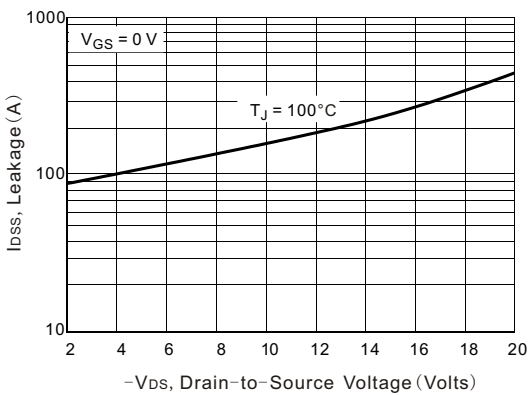
**Figure 3. On-Resistance vs. Gate-to-Source Voltage**



**Figure 4. On-Resistance vs. Drain Current and Gate Voltage**



**Figure 5. On-Resistance Variation with Temperature**



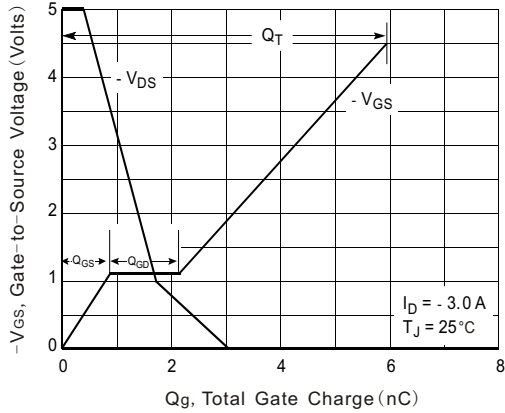
**Figure 6. Drain-to-Source Leakage Current vs. Voltage**



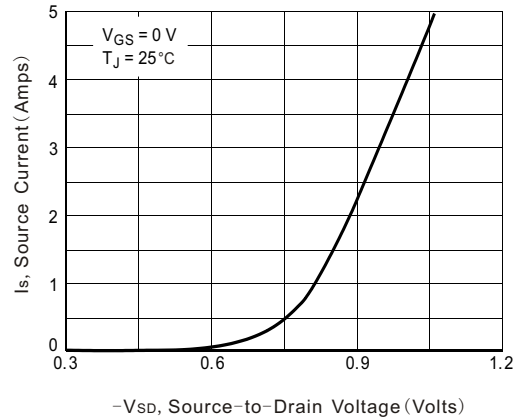
**Typical Electrical and Thermal Characteristics**

**Typical P-Channel Performance Curves**

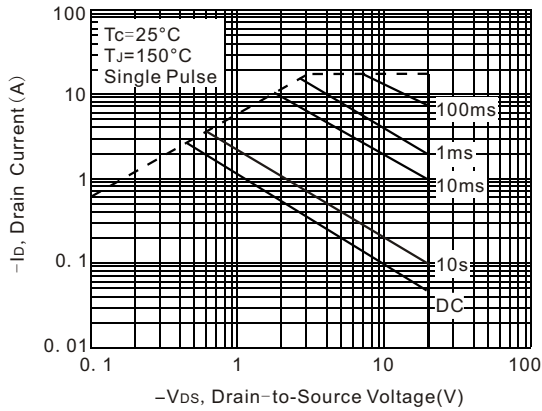
(T<sub>J</sub> = 25°C unless otherwise noted)



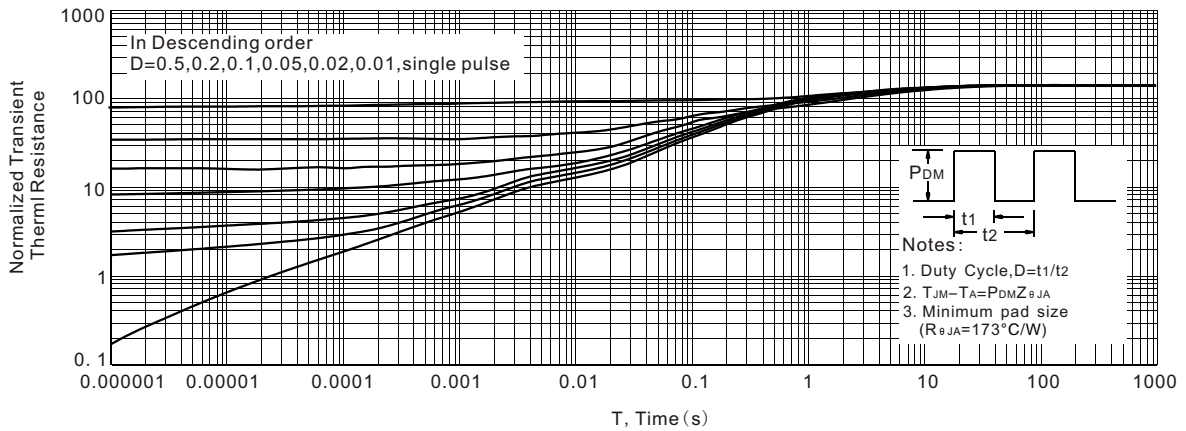
**Figure 7. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



**Figure 8. Diode Forward Voltage Vs. Current**



**Figure 9. Maximum Rated Forward Biased Safe Operating Area**



**Figure 10. Thermal Response**



### Typical Electrical and Thermal Characteristics

Typical Schottky Performance Curves ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

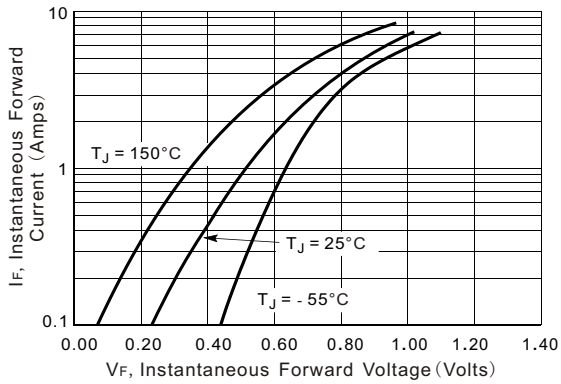


Figure 11. Typical Forward Voltage

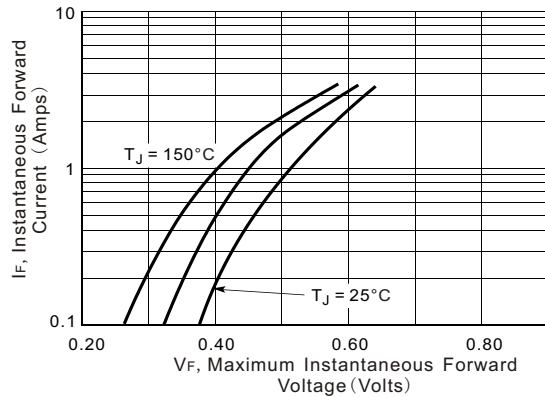


Figure 12. Maximum Forward Voltage

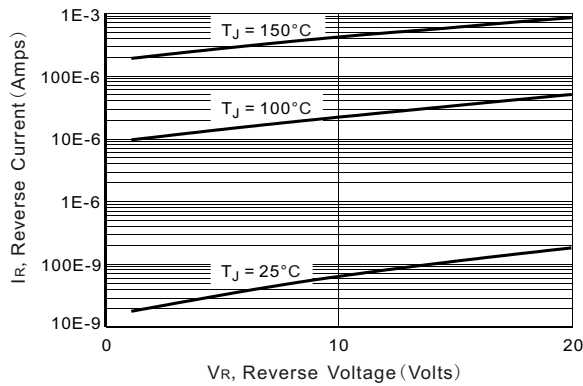


Figure 13. Typical Reverse Current

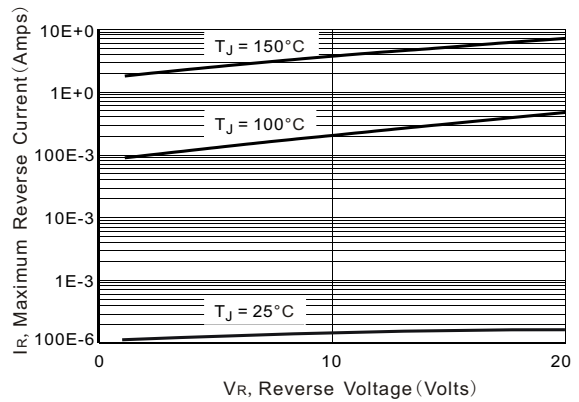


Figure 14. Maximum Reverse Current

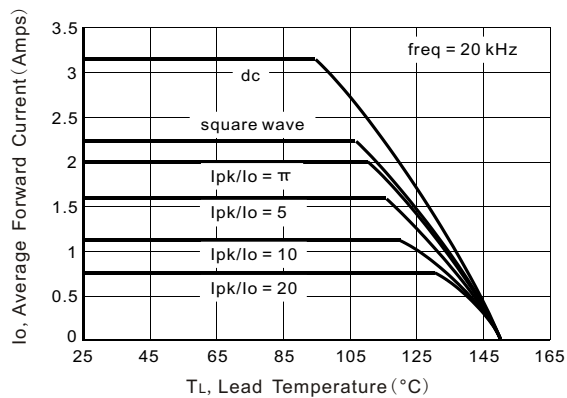


Figure 15. Current Derating

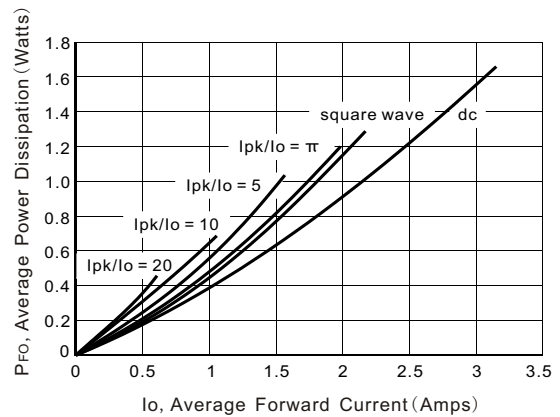
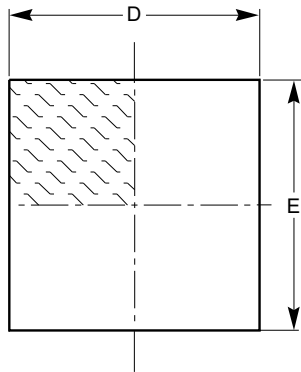


Figure 16. Forward Power Dissipation

**Package Outline**

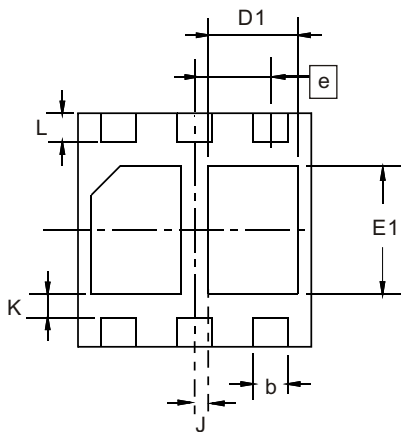
**DFN2x2 EP2\_6Lead**

Unit: mm

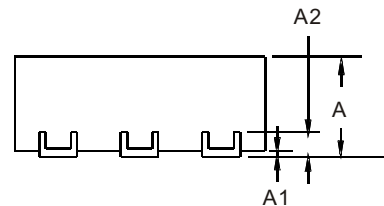


TOP VIEW

Symbol	Min	Nom	Max
A	0.70	0.75	0.80
A1	0.00	---	0.05
A2	0.20 REF		
b	0.25	0.30	0.35
D	2.00 BSC		
D1	0.60	0.65	0.70
E	2.00 BSC		
E1	0.80	0.85	0.90
e	0.65 BSC		
K	0.25 REF		
L	0.25	0.30	0.35
J	0.15 REF		



BOTTOM VIEW



SIDE VIEW

**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Package body sizes exclude mold flash and gate burrs.