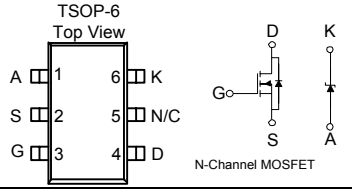
N-Channel 20-V (D-S) MOSFET With Schottky Diode

These miniature surface mount MOSFETs utilize a high cell density trench process to provide low $r_{DS(on)}$ and to ensure minimal power loss and heat dissipation. Typical applications are DC-DC converters and power management in portable and battery-powered products such as computers, printers, PCMCIA cards, cellular and cordless telephones.

- Low $r_{DS(on)}$ provides higher efficiency and extends battery life
- Low thermal impedance copper leadframe TSOP-6 saves board space
- Fast switching speed
- High performance trench technology

MOSFET PRODUCT SUMMARY		
V_{DS} (V)	$r_{DS(on)}$ (OHM)	I_D (A)
20	0.047 @ V_{GS} = -4.5V	±4.1
	0.055 @ V_{GS} = -2.5V	±3.8

SCHOTTKY PRODUCT SUMMARY		
V_{KA} (V)	V_f (V) Diode Forward Voltage	I_F (A)
20	0.48V @ 1.0A	1.0



ABSOLUTE MAXIMUM RATINGS (T_A = 25°C UNLESS OTHERWISE NOTED)				
Parameter		Symbol	Maximum	Units
Drain-Source Voltage (MOSFET)		V_{DS}	20	V
Reverse Voltage (Schottky)		V_{KA}	20	
Gate-Source Voltage (MOSFET)		V_{GS}	±8	
Continuous Drain Current (T_J=150°C) (MOSFET)[a]	T_A=25°C	I_D	±4.1	A
	T_A=70°C		±3.3	
Pulsed Drain Current (MOSFET)[b]		I_{DM}	±8	
Continuous Source Current (MOSFET Diode Conduction)[a]		I_S	1.05	
Average Forward Current (Schottky)		I_F	0.5	
Pulsed Forward Current (Schottky)		I_{FM}	8	
Maximum Power Dissipation (MOSFET)[a]	T_A=25°C	P_D	1.15	W
	T_A=70°C		0.7	
Maximum Power Dissipation (Schottky)[a]	T_A=25°C		1.0	
	T_A=70°C		0.6	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to 150	°C

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typ	Max	
Maximum Junction-to-Ambient[a]	t <= 10 sec	R_{thJA}	93	110	°C/W
	Steady State		130	150	

Notes

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

b. Pulse width limited by maximum junction temperature

MOSFET SPECIFICATIONS (T_A = 25°C UNLESS OTHERWISE NOTED)						
Parameter	Symbol	Test Conditions	Limits			Unit
			Min	Typ	Max	
Static						
Gate-Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 uA	0.4			
Gate-Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = +/-8 V			±100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 16 V, V_{GS} = 0 V			1	uA
		V_{DS} = 16 V, V_{GS} = 0 V, T_J = 55°C			10	
On-State Drain Current[A]	$I_{D(on)}$	V_{DS} = 5 V, V_{GS} = 4.5 V	5			A
Drain-Source On-State Resistance[A]	$r_{DS(on)}$	V_{GS} = 4.5 V, I_D = 4.1 A			0.047	Ω
		V_{GS} = 2.5 V, I_D = 3.8 A			0.055	
Forward Tranconductance[A]	g_{fs}	V_{DS} = 5 V, I_D = 4.1 A		3		S
Diode Forward Voltage	V_{SD}	I_S = 1.05 A, V_{GS} = 0 V		0.80		V
Dynamic[b]						
Total Gate Charge	Q_g	V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 4.1 A		7.5		nC
Gate-Source Charge	Q_{gs}			0.6		
Gate-Drain Charge	Q_{gd}			1.0		
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 5 V, R_L = 5 OHM, V_{GEN} = 4.5 V, R_G = 6 OHM		5		ns
Rise Time	t_r			12		
Turn-Off Delay Time	$t_{d(off)}$			13		
Fall-Time	t_f			7		

SCHOTTKY SPECIFICATIONS (T_A = 25°C UNLESS OTHERWISE NOTED)						
Parameter	Symbol	Test Conditions	Limits			Unit
			Min	Typ	Max	
Forward Voltage Drop	V_F	I_F = 0.5 A			0.48	V
		I_F = 0.5 A, T_J = 125°C			0.4	V
Maximum Reverse Leakage Current	I_{rm}	V_r = 30 V			0.1	mA
		V_r = 30 V, T_J = 75°C			1	
		V_r = 30 V, T_J = 125°C			10	
Junction Capacitance	C_T	V_r = 10 V		31		pF

Notes

a. Pulse test: PW <= 300us duty cycle <= 2%.

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

Typical Electrical Characteristics

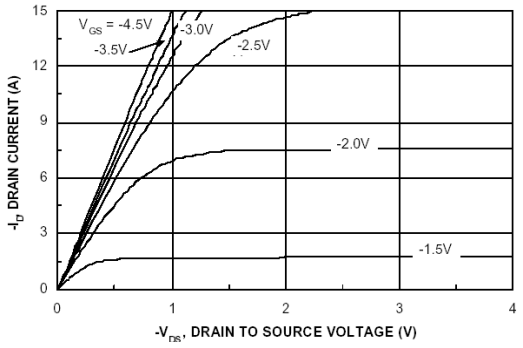


Figure 1. On-Region Characteristics

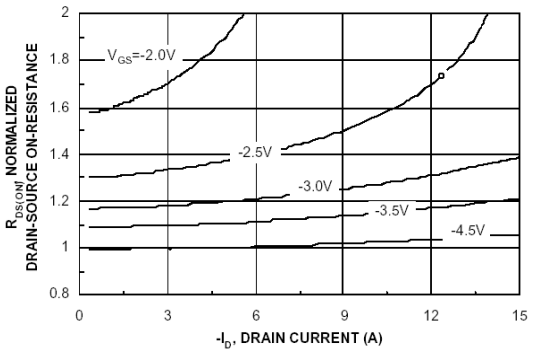


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

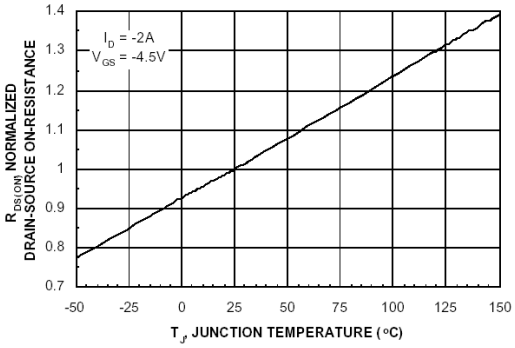


Figure 3. On-Resistance Variation with Temperature

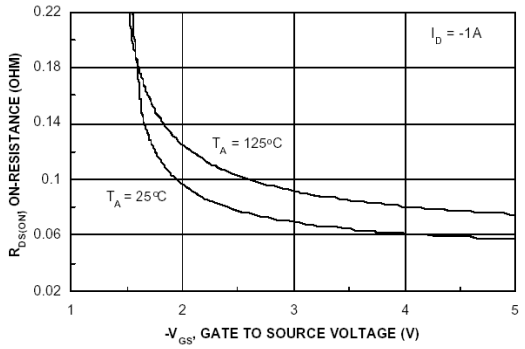


Figure 4. On-Resistance Variation with Gate to Source Voltage

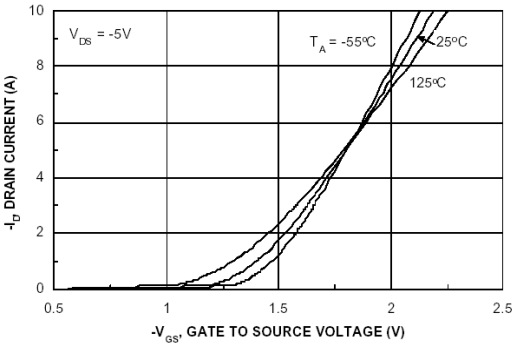


Figure 5. Transfer Characteristics

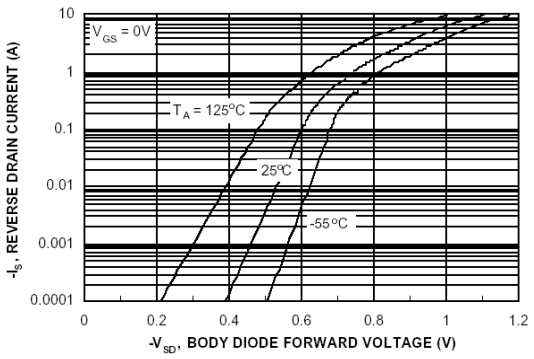


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

Typical Electrical Characteristics

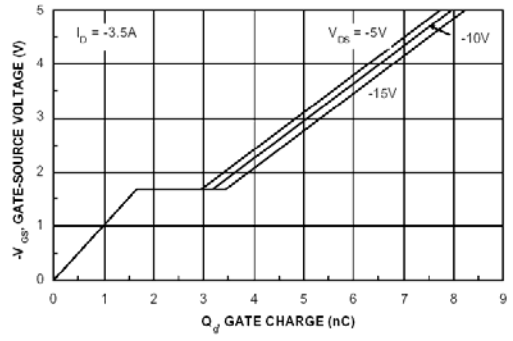


Figure 7. Gate Charge Characteristic

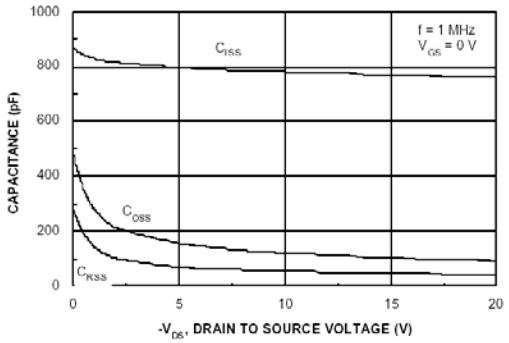


Figure 8. Capacitance Characteristic

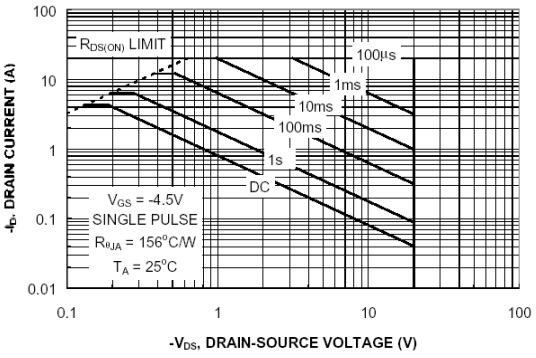


Figure 9. Maximum Safe Operating Area

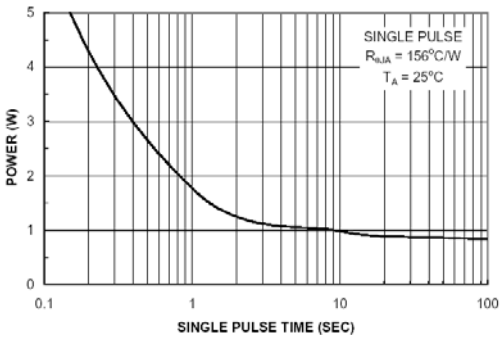


Figure 10. Single Pulse Maximum Power Dissipation

Normalized Thermal Transient Junction to Ambient

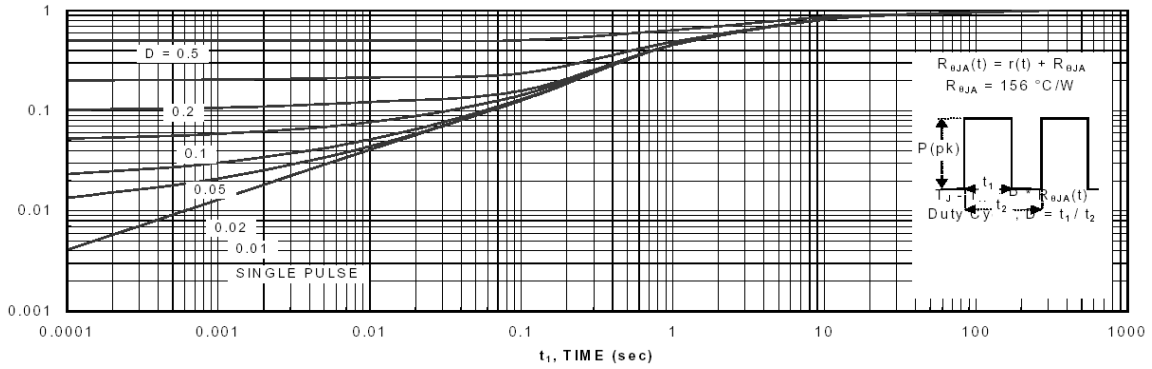
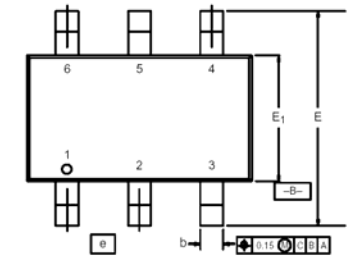
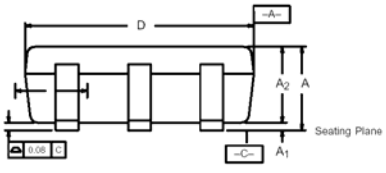


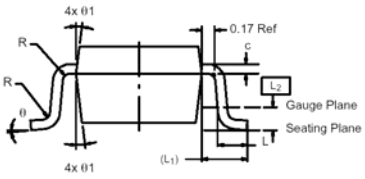
Figure 11. Transient Thermal Response Curve.

Package Information

TSOP-6: 6LEAD







Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.91	–	1.10	0.036	–	0.043
A_1	0.01	–	0.10	0.0004	–	0.004
A_2	0.84	–	1.00	0.033	0.038	0.039
b	0.30	0.32	0.45	0.012	0.013	0.018
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.95	3.05	3.10	0.116	0.120	0.122
E	2.70	2.85	2.98	0.106	0.112	0.117
E_1	1.55	1.65	1.70	0.061	0.065	0.067
e	1.00 BSC			0.0394 BSC		
L	0.35	–	0.50	0.014	–	0.020
L_1	0.60 Ref			0.024 Ref		
L_2	0.25 BSC			0.010 BSC		
R	0.10	–	–	0.004	–	–
θ	0°	4°	8°	0°	4°	8°
θ_1	7° Nom			7° Nom		