

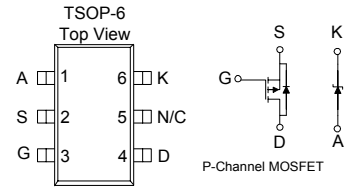
P-Channel 20-V (D-S) MOSFET With Schottky Diode

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	0.130 @ $V_{GS} = -4.5V$	± 2.5
	0.190 @ $V_{GS} = -2.5V$	± 1.9

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 ($T_A = 25^\circ C$ 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 ($T_j = 150^\circ C$) (MOSFET) ^a	$T_A = 25^\circ C$	I_D	± 2.5	A
	$T_A = 70^\circ C$		± 1.9	
Pulsed Drain Current (MOSFET) ^b		I_{DM}	± 10	
Continuous Source Current (MOSFET Diode Conduction) ^a		I_S	-1.6	
Average Forward Current (Schottky)		I_F	0.5	
Pulsed Forward Current (Schottky)		I_{FM}	8	
Maximum Power Dissipation (MOSFET) ^a	$T_A = 25^\circ C$	P_D	1.15	
	$T_A = 70^\circ C$		0.7	
Maximum Power Dissipation (Schottky) ^a	$T_A = 25^\circ C$		1.0	
	$T_A = 70^\circ C$		0.6	
Operating Junction and Storage Temperature Range		T_j, T_{stg}	-55 to 150	$^\circ C$

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typ	Max	
Maximum Junction-to-Ambient ^a	$t \leq 10$ sec	R_{thJA}	93	110	$^\circ C/W$
	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 μA	-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	μA
		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 = -2.5 A			0.130	Ω
		V _{GS} = -2.5 V, I _D = -1.9 A			0.190	
Forward Transconductance ^A	g _{fs}	V _{DS} = -5 V, I _D = -2.5 A		3		S
Diode Forward Voltage	V _{SD}	I _S = -1.6 A, V _{GS} = 0 V		-0.70		V
Dynamic^b						
Total Gate Charge	Q _g	V _{DS} = -5 V, V _{GS} = -4.5 V, I _D = -2.5 A		6.0		nC
Gate-Source Charge	Q _{gs}			0.80		
Gate-Drain Charge	Q _{gd}			1.30		
Turn-On Delay Time	t _{d(on)}	V _{DD} = -5 V, R _L = 5 Ω, V _{GEN} = -4.5 V, R _G = 6 Ω		6.5		ns
Rise Time	t _r			20		
Turn-Off Delay Time	t _{d(off)}			31		
Fall-Time	t _f			21		

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.

FREESCALE reserves the right to make changes without further notice to any products herein. freescale makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does freescale assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in freescale data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. freescale does not convey any license under its patent rights nor the rights of others. freescale products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the freescale product could create a situation where personal injury or death may occur. Should Buyer purchase or use freescale products for any such unintended or unauthorized application, Buyer shall indemnify and hold freescale and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that freescale was negligent regarding the design or manufacture of the part. freescale is an Equal Opportunity/Affirmative Action Employer.

Typical Electrical Characteristics

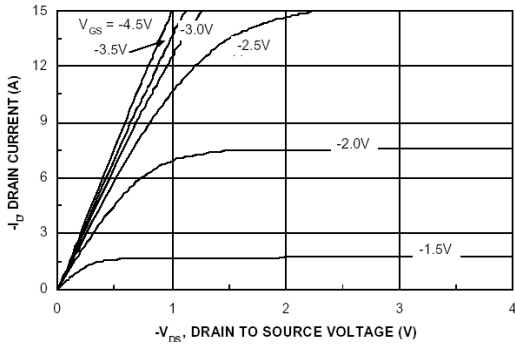


Figure 1. On-Region Characteristics

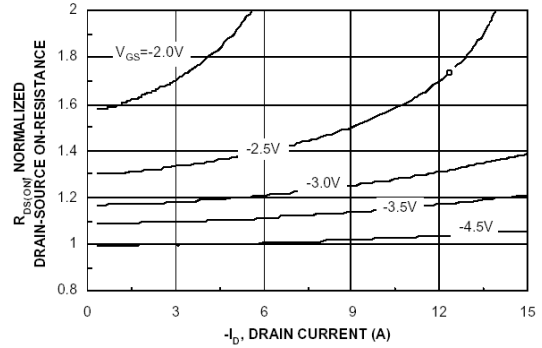


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

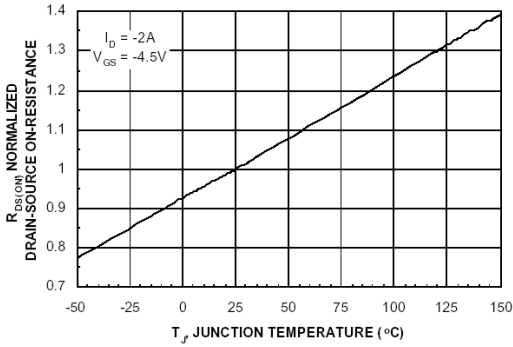


Figure 3. On-Resistance Variation with Temperature

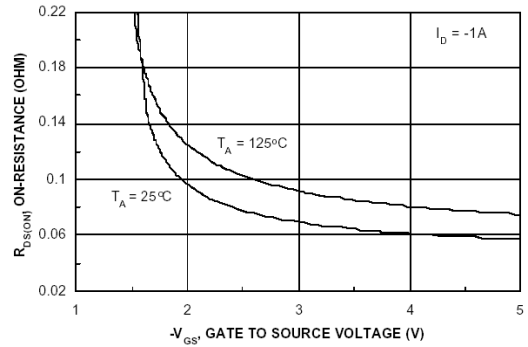


Figure 4. On-Resistance Variation with Gate to Source Voltage

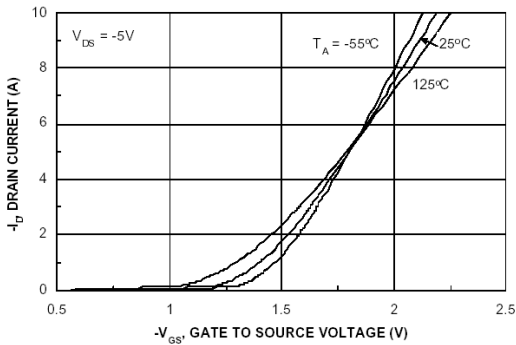


Figure 5. Transfer Characteristics

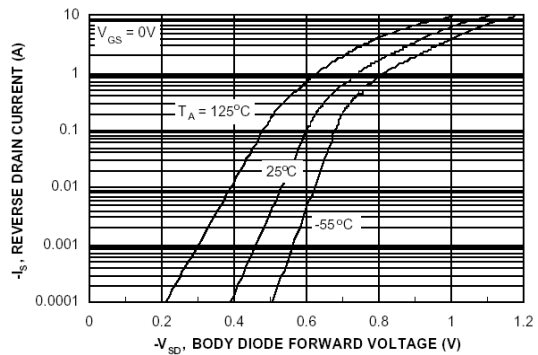


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

Typical Electrical Characteristics

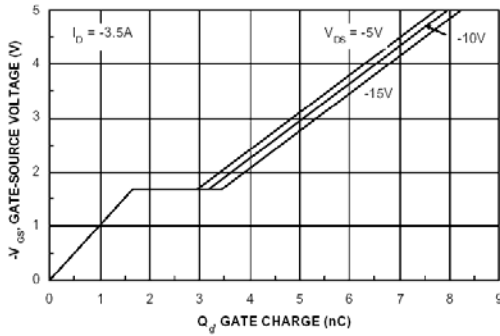


Figure 7. Gate Charge Characteristic

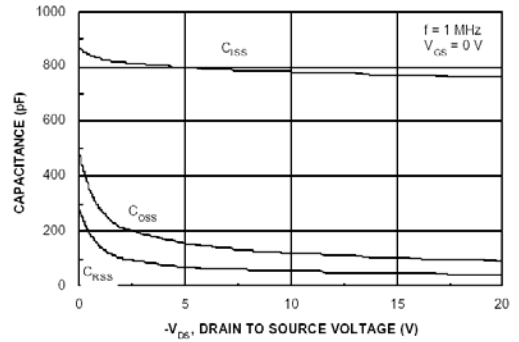


Figure 8. Capacitance Characteristic

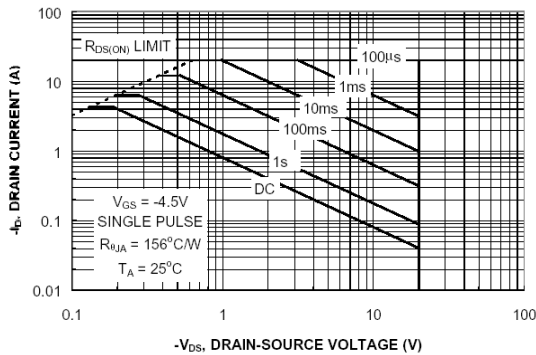


Figure 9. Maximum Safe Operating Area

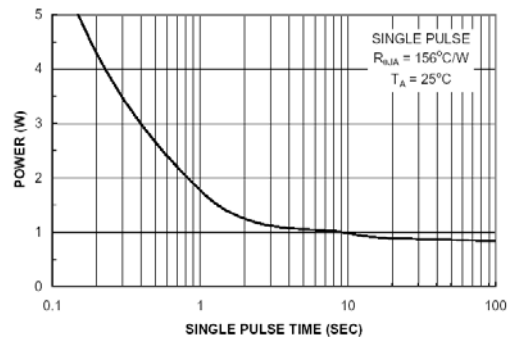


Figure 10. Single Pulse Maximum Power Dissipation

Normalized Thermal Transient Junction to Ambient

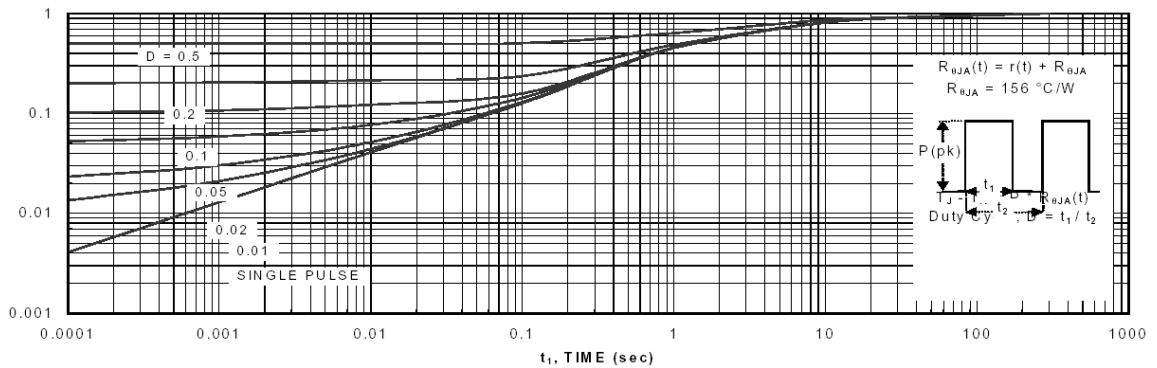
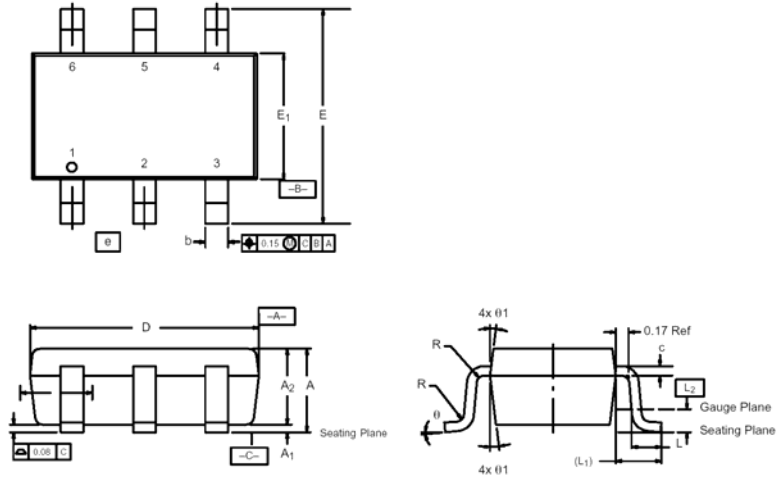


Figure 11. Transient Thermal Response Curve.

Package Information

TSOP-6: 6LEAD



Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.91	–	1.10	0.036	–	0.043
A₁	0.01	–	0.10	0.0004	–	0.004
A₂	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
E₁	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
L₁	0.60 Ref			0.024 Ref		
L₂	0.25 BSC			0.010 BSC		
R	0.10	–	–	0.004	–	–
θ	0°	4°	8°	0°	4°	8°
θ₁	7° Nom			7° Nom		