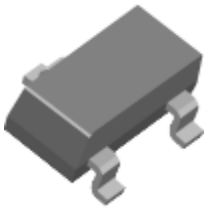
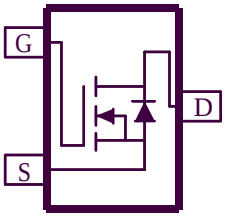
N-Channel 20-V (D-S) MOSFET

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.

PRODUCT SUMMARY		
V_{DS} (V)	$r_{DS(on)}$ (Ω)	I_D (A)
20	0.047 @ V_{GS} = 4.5V	4.3
	0.055@ V_{GS} = 2.5V	4.0
	0.087@ V_{GS} = 1.8V	3.2

- Low $r_{DS(on)}$ provides higher efficiency and extends battery life
- Low thermal impedance copper leadframe SOT-23 saves board space
- Fast switching speed
- High performance trench technology





ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C UNLESS OTHERWISE NOTED)				
Parameter		**Symbol**	**Ratings**	**Units**
Drain-Source Voltage		V_{DS}	20	V
Gate-Source Voltage		V_{GS}	±8	
Continuous Drain Current[a]	T_A=25°C	I_D	4.3	A
	T_A=70°C		3.6	
Pulsed Drain Current[b]		I_{DM}	10	
Continuous Source Current (Diode Conduction)[a]		I_S	1.6	A
Power Dissipation[a]	T_A=25°C	P_D	1.3	W
	T_A=70°C		0.9	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to 150	°C

THERMAL RESISTANCE RATINGS				
Parameter		**Symbol**	**Maximum**	**Units**
Maximum Junction-to-Ambient[a]	t <= 5 sec	R_{THJA}	100	°C/W
	Steady-State		166	

Notes

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

b. Pulse width limited by maximum junction temperature

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			1	uA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 16 V, V_{GS} = 0 V			0.1	uA
		V_{DS} = 16 V, V_{GS} = 0 V, T_J = 55°C			1	
On-State Drain Current[A]	$I_{D(on)}$	V_{DS} = 5 V, V_{GS} = 4.5 V	5			A
Drain-Source On-Resistance[A]	$r_{DS(on)}$	V_{GS} = 4.5 V, I_D = 1 A			0.047	Ω
		V_{GS} = 2.5 V, I_D = 1 A			0.055	
		V_{GS} = 1.8 V, I_D = 1 A			0.087	
Forward Tranconductance[A]	g_{fs}	V_{DS} = 5 V, I_D = 1 A		16		S
Diode Forward Voltage	V_{SD}	I_S = 1 A, V_{GS} = 0 V		0.6		V
Dynamic[b]						
Total Gate Charge	Q_g	V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 1 A		6		nC
Gate-Source Charge	Q_{gs}			1		
Gate-Drain Charge	Q_{gd}			2		
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 10 V, R_L = 6 Ω , R_G = 6 Ω, V_{GEN} = 4.5 V		8		ns
Rise Time	t_r			16		
Turn-Off Delay Time	$t_{d(off)}$			30		
Fall-Time	t_f			14		

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

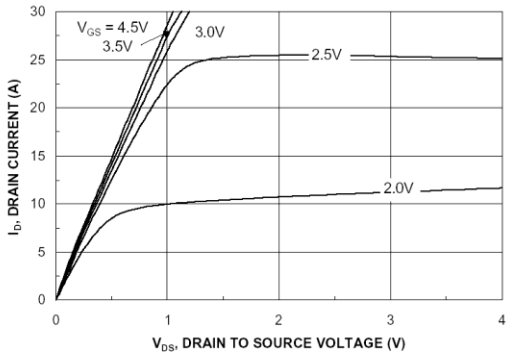


Figure 1. On-Region Characteristics

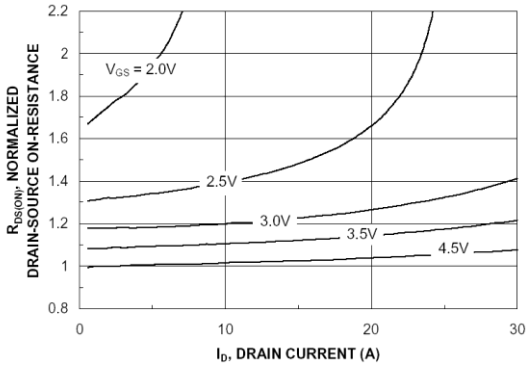


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

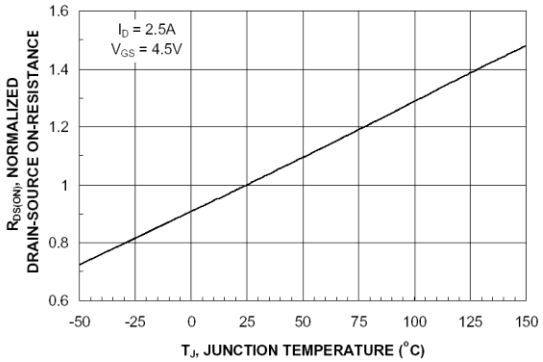


Figure 3. On-Resistance Variation with Temperature

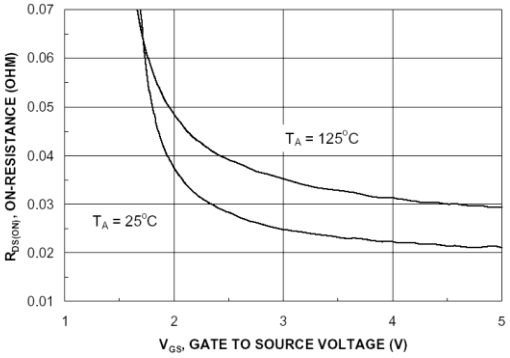


Figure 4. On-Resistance Variation with Gate to Source Voltage

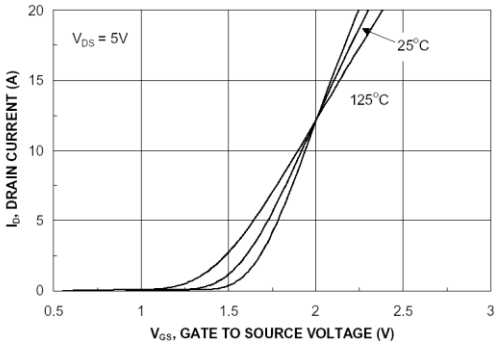


Figure 5. Transfer Characteristics

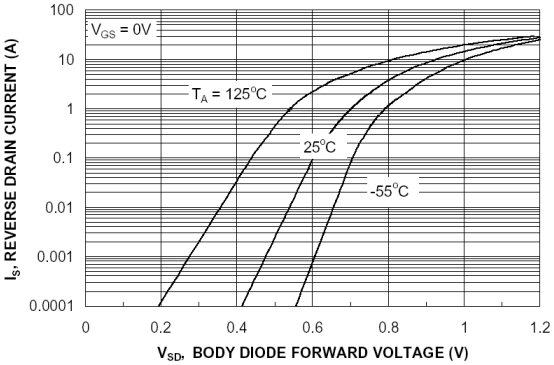


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

Typical Electrical Characteristics

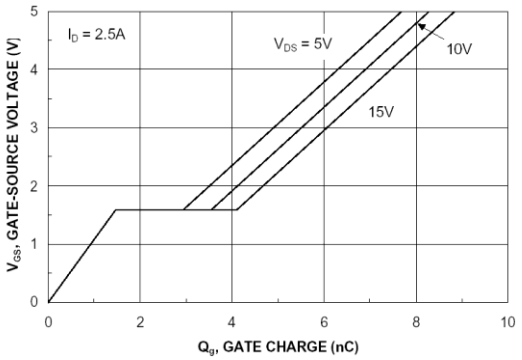


Figure 7. Gate Charge Characteristics

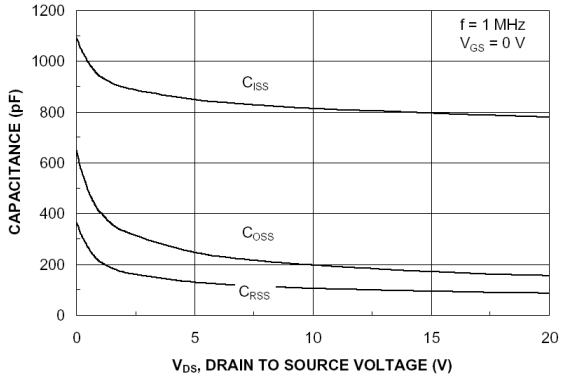


Figure 8. Capacitance Characteristics

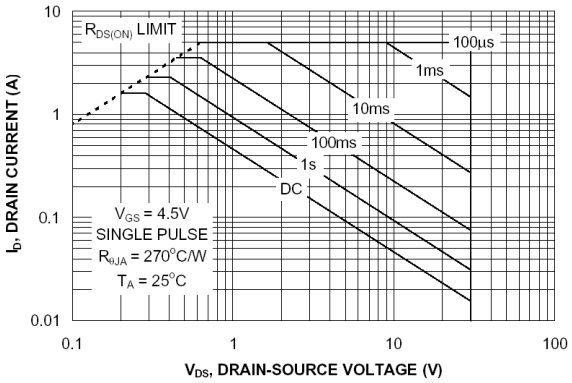


Figure 9. Maximum Safe Operating Area

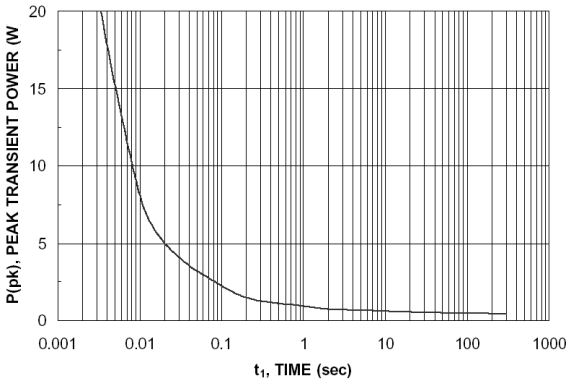


Figure 10. Single Pulse Maximum Power Dissipation

Normalized Thermal Transient Junction to Ambient

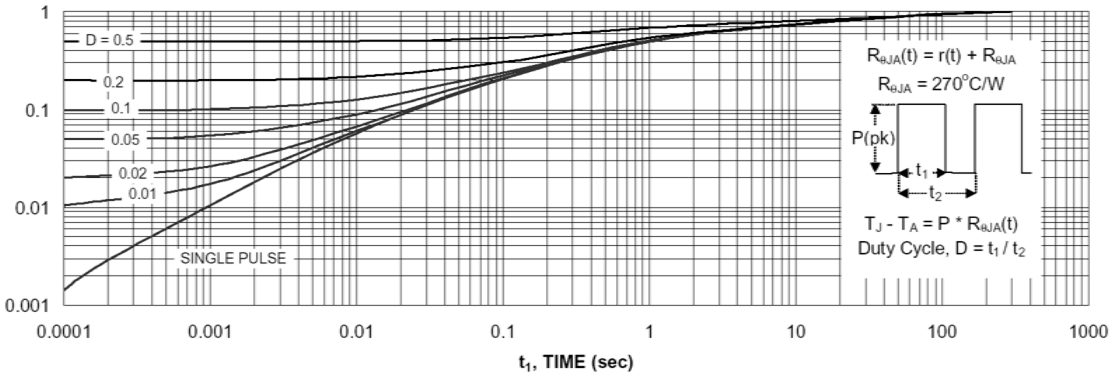
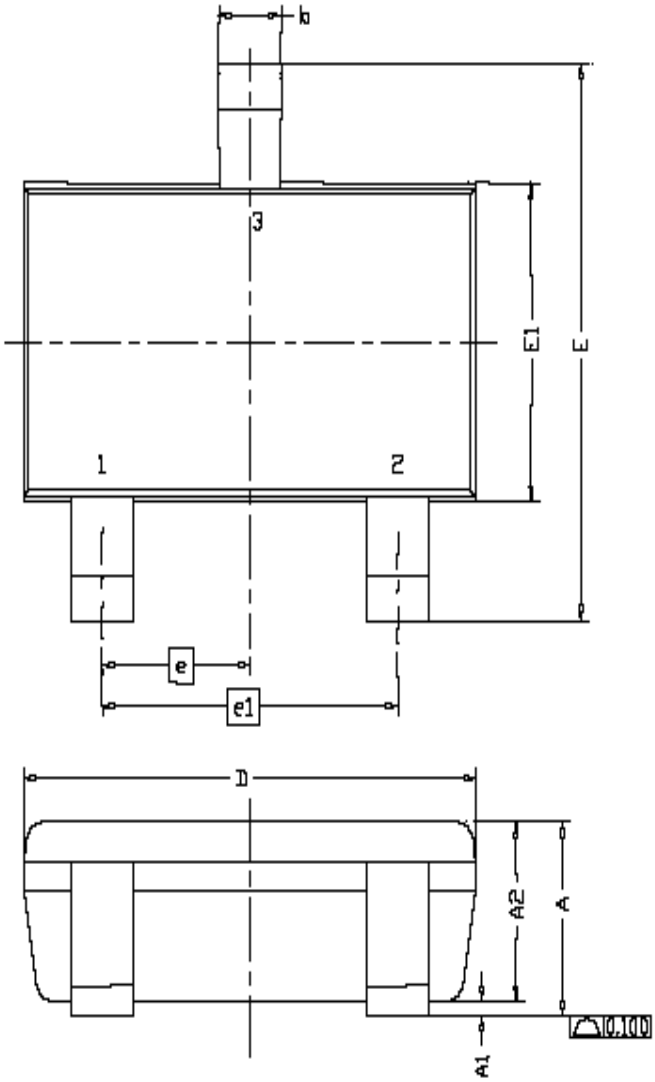
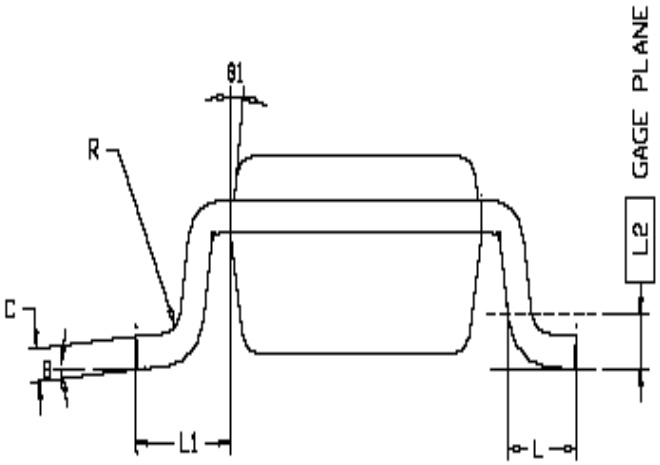


Figure 11. Transient Thermal Response Curve

Package Information



DIM.	MILLIMETERS		
	MIN	NOM	MAX
A	0.935	0.95	1.10
A1	0.01	---	0.10
A2	0.85	0.90	0.925
b	0.30	0.40	0.50
c	0.10	0.15	0.25
D	2.70	2.90	3.10
E	2.60	2.80	3.00
E1	1.40	1.60	1.80
e	0.95 BSC		
e1	1.90 BSC		
L	0.30	0.40	0.60
L1	0.60REF		
L2	0.25BSC		
R	0.10	---	---
θ	0°	4°	8°
θ1	7°NOM