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www.onsemi.com

MMDFS2P102

Power MOSFET 2 Amps, 20 Volts

P−Channel SO−8, FETKY™

The FETKY product family incorporates low $R_{DS(on)}$, true logic level MOSFETs packaged with industry leading, low forward drop, low leakage Schottky Barrier rectifiers to offer high efficiency components in a space saving configuration. Independent pinouts for MOSFET and Schottky die allow the flexibility to use a single component for switching and rectification functions in a wide variety of applications such as Buck Converter, Buck−Boost, Synchronous Rectification, Low Voltage Motor Control, and Load Management in Battery Packs, Chargers, Cell Phones and other Portable Products.

- Power MOSFET with Low V_F, Low I_R Schottky Rectifier
- Lower Component Placement and Inventory Costs along with Board Space Savings
- Logic Level Gate Drive − Can be Driven by Logic ICs
- Mounting Information for SO−8 Package Provided
- I_{DSS} Specified at Elevated Temperature
- Applications Information Provided

MOSFET MAXIMUM RATINGS (T_J = 25°C unless otherwise noted) (Note 1.)

Rating	Symbol	Value	Unit
Drain−to−Source Voltage	V_{DSS}	20	Vdc
Drain−to−Gate Voltage (R_{GS} = 1.0 MΩ)	V_{DGR}	20	Vdc
Gate−to−Source Voltage − Continuous	V_{GS}	±20	Vdc
Drain Current (Note 3.) − Continuous @ T_A = 25°C − Continuous @ T_A = 100°C − Single Pulse (tp ≤ 10 μs)	 I_D I_D I_{DM}	 3.3 2.1 20	 Adc Apk
Total Power Dissipation @ T_A = 25°C (Note 2.)	P_D	2.0	Watts
Single Pulse Drain−to−Source Avalanche Energy − STARTING T_J = 25°C V_{DD} = 30 Vdc, V_{GS} = 5.0 Vdc, V_{DS} = 20 Vdc, I_L = 9.0 Apk, L = 10 mH, R_G = 25 Ω	E_{AS}	324	mJ

1. Negative sign for P−channel device omitted for clarity.
2. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.
3. Mounted on 2″ square FR4 board (1″ sq. 2 oz. Cu 0.06″ thick single sided), 10 sec. max.

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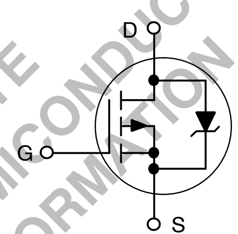
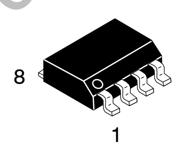
2 AMPERES
20 VOLTS
$R_{DS(on)}$ = 160 mΩ
V_F = 0.39 Volts

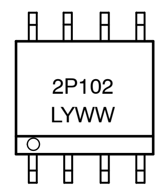
P−Channel



MARKING DIAGRAM

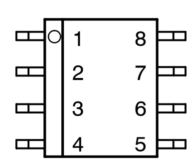


SO−8
CASE 751
STYLE 18



L = Location Code
Y = Year
WW = Work Week

PIN ASSIGNMENT



Top View

ORDERING INFORMATION

Device	Package	Shipping
MMDFS2P102R2	SO−8	2500 Tape & Reel

SCHOTTKY RECTIFIER MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Peak Repetitive Reverse Voltage DC Blocking Voltage	V_{RRM} V_R	20	Volts
Average Forward Current (Note 1) (Rated V_R) T_A = 100°C	I_O	1.0	Amps
Peak Repetitive Forward Current (Note 3.) (Rated V_R, Square Wave, 20 kHz) T_A = 105°C	I_{frm}	2.0	Amps
Non−Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{fsm}	20	Amps

THERMAL CHARACTERISTICS − SCHOTTKY AND MOSFET

Thermal Resistance − Junction−to−Ambient (Note 2) − MOSFET	$R_{\theta JA}$	167	°C/W
Thermal Resistance − Junction−to−Ambient (Note 3) − MOSFET	$R_{\theta JA}$	100	
Thermal Resistance − Junction−to−Ambient (Note 3.) − MOSFET	$R_{\theta JA}$	62.5	
Thermal Resistance − Junction−to−Ambient (Note 2) − Schottky	$R_{\theta JA}$	204	
Thermal Resistance − Junction−to−Ambient (Note 3) − Schottky	$R_{\theta JA}$	122	
Thermal Resistance − Junction−to−Ambient (Note 1) − Schottky	$R_{\theta JA}$	83	
Operating and Storage Temperature Range	T_j, T_{stg}	−55 to 150	

1. Mounted on 2″ square FR4 board (1″ sq. 2 oz. Cu 0.06″ thick single sided), 10 sec. max.
2. Mounted with minimum recommended pad size, PC Board FR4.
3. Mounted on 2″ square FR4 board (1″ sq. 2 oz. Cu 0.06″ thick single sided), Steady State.

MOSFET ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (Note 4)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain−Source Voltage (V_{GS} = 0 Vdc, I_D = 0.25 mA)	$V_{(BR)DSS}$	20	–	–	Vdc
Temperature Coefficient (Positive)		–	25	–	mV/°C
Zero Gate Drain Current (V_{DS} = 30 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	–	–	1.0	μAdc
(V_{DS} = 20 Vdc, V_{GS} = 0 Vdc, T_J = 125°C)		–	–	10	
Gate Body Leakage Current (V_{GS} = ± 20 Vdc, V_{DS} = 0)	I_{GSS}	–	–	100	nAdc
ON CHARACTERISTICS (Note 5)					
Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = 0.25 mA)	$V_{GS(th)}$	1.0	1.5	2.0	Vdc
Temperature Coefficient (Negative)		–	4.0	–	mV/°C
Static Drain−Source Resistance (V_{GS} = 10 Vdc, I_D = 2.0 Adc)	$R_{DS(on)}$	–	0.118	0.160	Ohms
(V_{GS} = 4.5 Vdc, I_D = 2.5 Adc)		–	0.152	0.180	
Forward Transconductance (V_{DS} = 3.0 Vdc, I_D = 1.0 Adc)	g_{FS}	2.0	3.0	–	mhos
DYNAMIC CHARACTERISTICS (V_{DS} = 16 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)					
Input Capacitance	C_{iss}	–	420	588	pF
Output Capacitance	C_{oss}	–	290	406	
Reverse Transfer Capacitance	C_{rss}	–	116	232	
SWITCHING CHARACTERISTICS (Note 6) (V_{DS} = 10 Vdc, I_D = 2.0 Adc, V_{GS} = 4.5 Vdc, R_G = 6.0 Ω)					
Turn−On Delay Time	$t_{d(on)}$	–	19	38	ns
Rise Time	t_r	–	66	132	
Turn−Off Delay Time	$t_{d(off)}$	–	25	50	
Fall Time	t_f	–	37	74	
Gate Charge (V_{DS} = 16 Vdc, I_D = 2.0 Adc, V_{GS} = 10 Vdc)	Q_T	–	15	20	nC
	Q_1	–	1.2	–	
	Q_2	–	5.0	–	
	Q_3	–	4.0	–	
DRAIN SOURCE DIODE CHARACTERISTICS					
Forward On−Voltage (Note 5) (I_S = 2.0 Adc, V_{GS} = 0 Vdc)	V_{SD}	–	1.5	2.1	V
Reverse Recovery Time (I_S = 2.0 Adc, V_{DD} = 15 V, dIS/dt = 100 A/μs)	t_{rr}	–	38	–	ns
	t_a	–	17	–	
	t_b	–	21	–	
Reverse Recovery Stored Charge	Q_{RR}	–	0.034	–	μC

SCHOTTKY RECTIFIER ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	T_J = 25°C	T_J = 125°C	Unit
Maximum Instantaneous Forward Voltage (Note 5) I_F = 1.0 A	V_F	0.47	0.39	Volts
I_F = 2.0 A		0.58	0.53	
Maximum Instantaneous Reverse Current (Note 5) V_R = 20 V	I_R	0.05	10	mA
Maximum Voltage Rate of Change V_R = 20 V	dV/dt	10,000		V/μs

4. Negative sign for P−channel device omitted for clarity.
5. Pulse Test: Pulse Width ≤ 300 μsec, Duty Cycle ≤ 2.0%.
6. Switching characteristics are independent of operating temperature.

TYPICAL FET ELECTRICAL CHARACTERISTICS

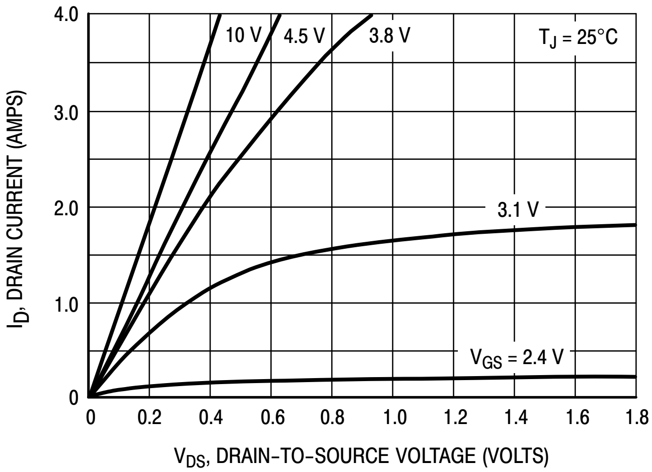


Figure 1. On−Region Characteristics

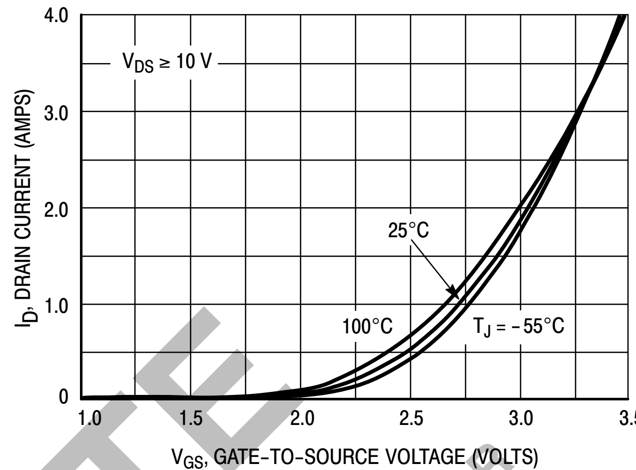


Figure 2. Transfer Characteristics

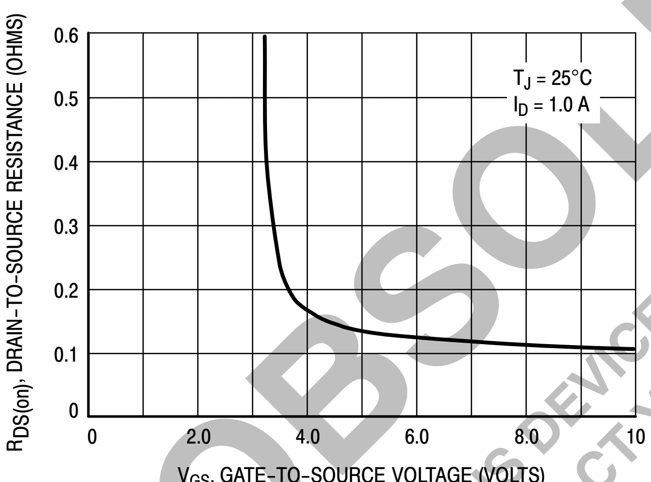


Figure 3. On−Resistance versus Gate−To−Source Voltage

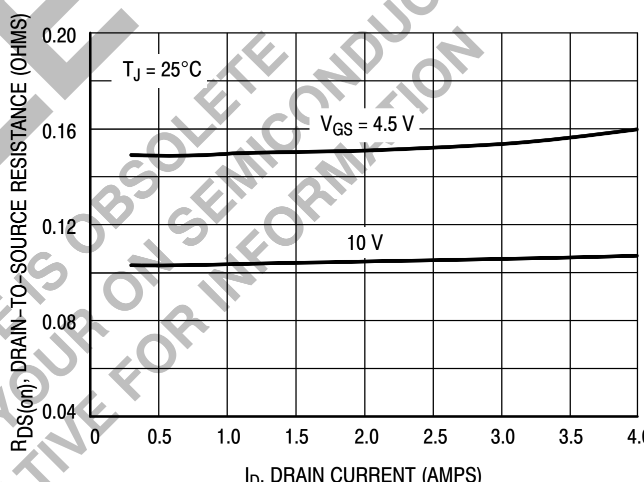


Figure 4. On−Resistance versus Drain Current and Gate Voltage

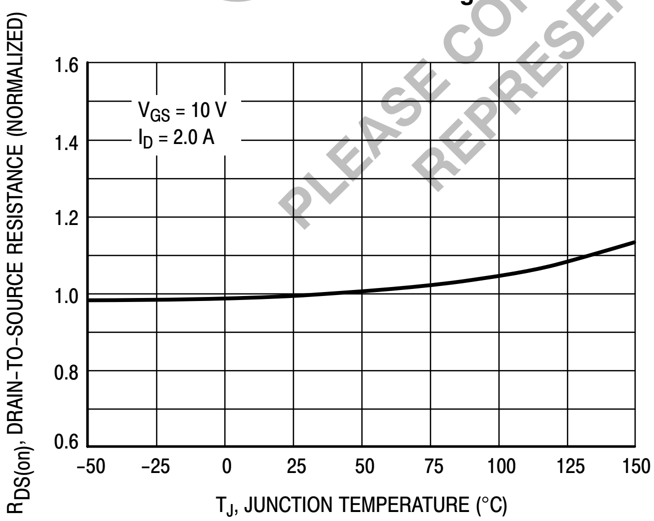


Figure 5. On−Resistance Variation with Temperature

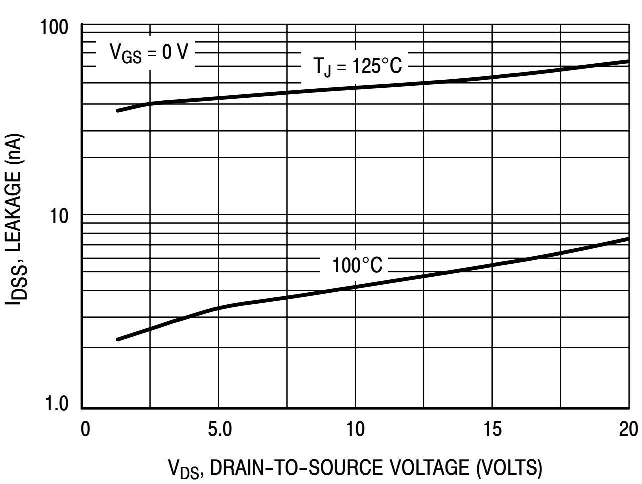


Figure 6. Drain−To−Source Leakage Current versus Voltage

TYPICAL FET ELECTRICAL CHARACTERISTICS

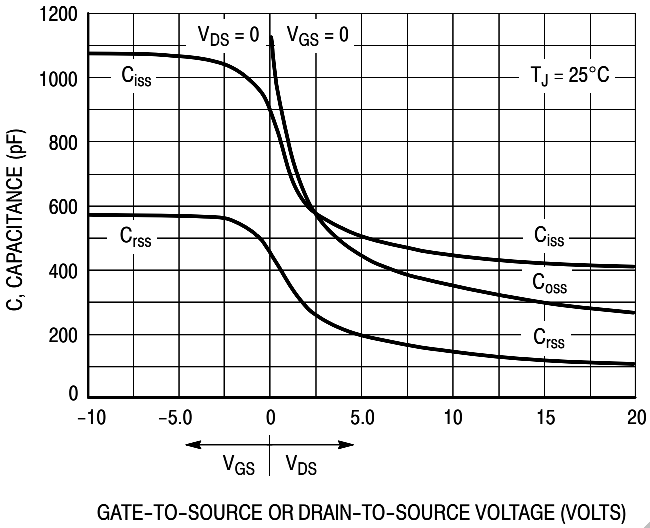


Figure 7. Capacitance Variation

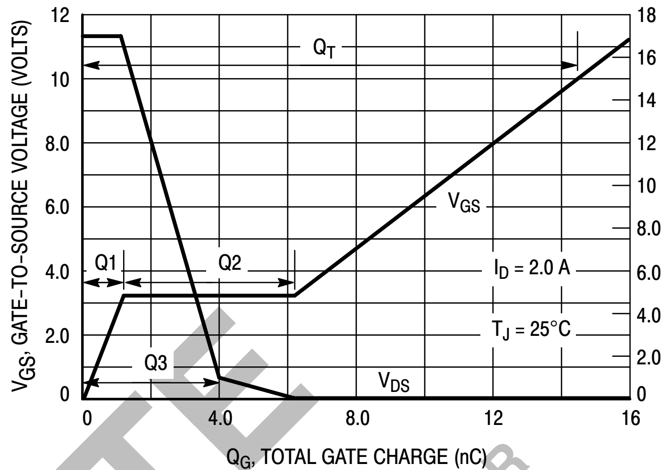


Figure 8. Gate−To−Source and Drain−To−Source Voltage versus Total Charge

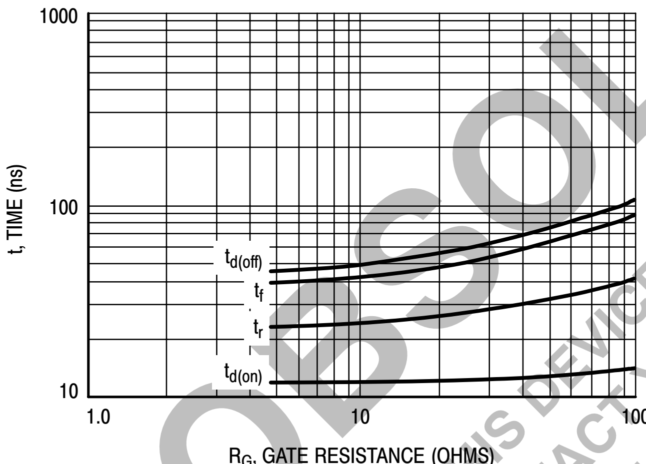


Figure 9. Resistive Switching Time Variation versus Gate Resistance

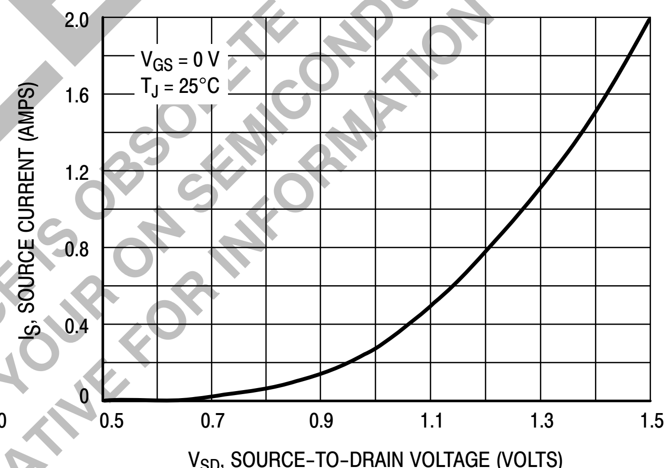


Figure 10. Diode Forward Voltage versus Current

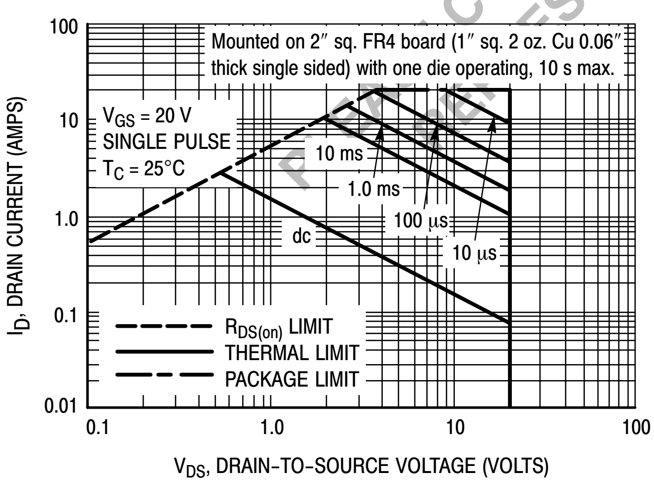


Figure 11. Maximum Rated Forward Biased Safe Operating Area

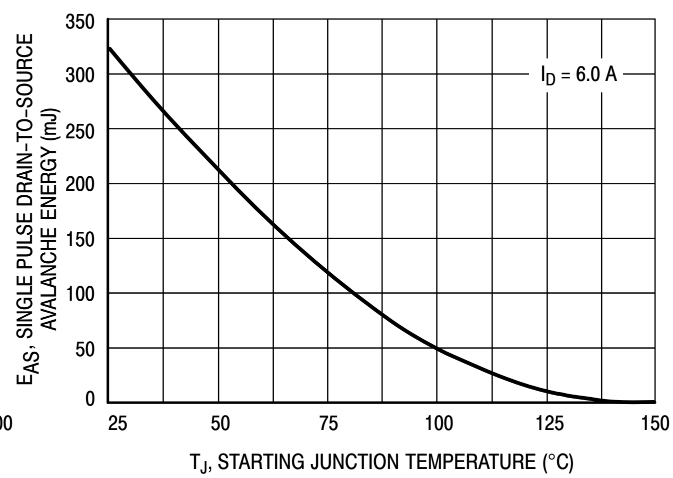


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

TYPICAL FET ELECTRICAL CHARACTERISTICS

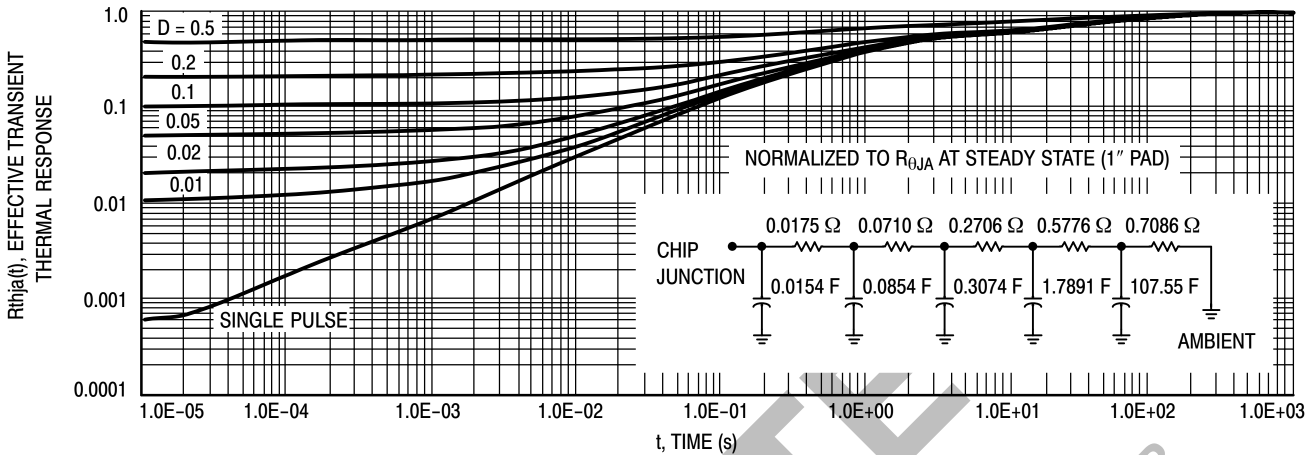


Figure 13. FET Thermal Response

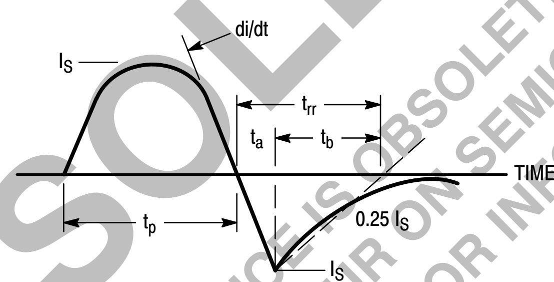


Figure 14. Diode Reverse Recovery Waveform

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

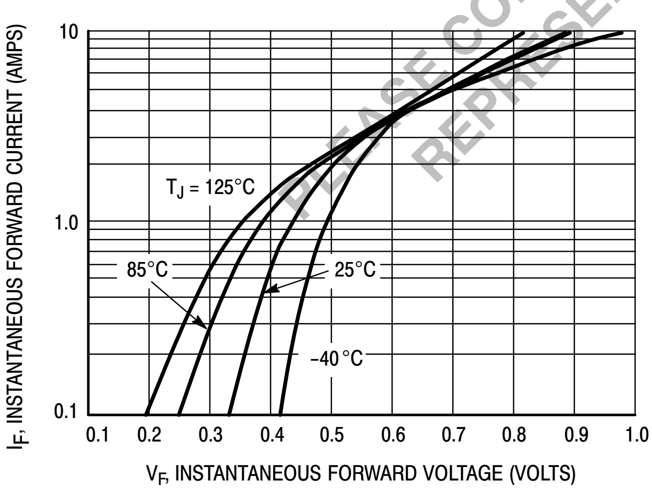


Figure 15. Typical Forward Voltage

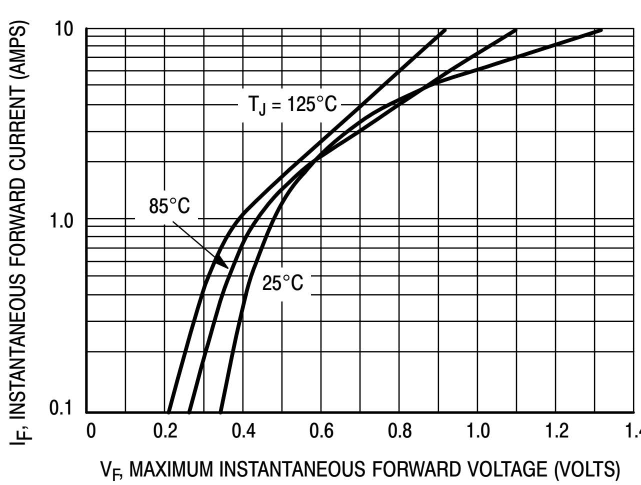


Figure 16. Maximum Forward Voltage

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

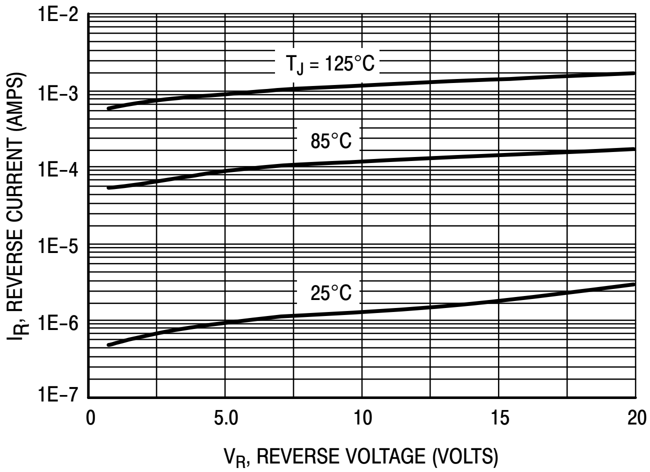


Figure 17. Typical Reverse Current

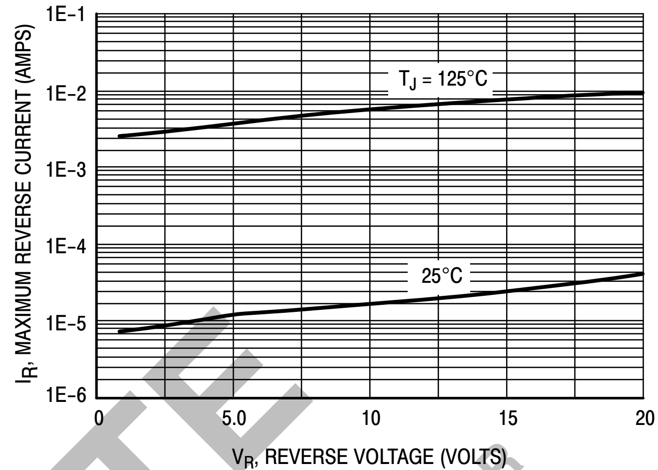


Figure 18. Maximum Reverse Current

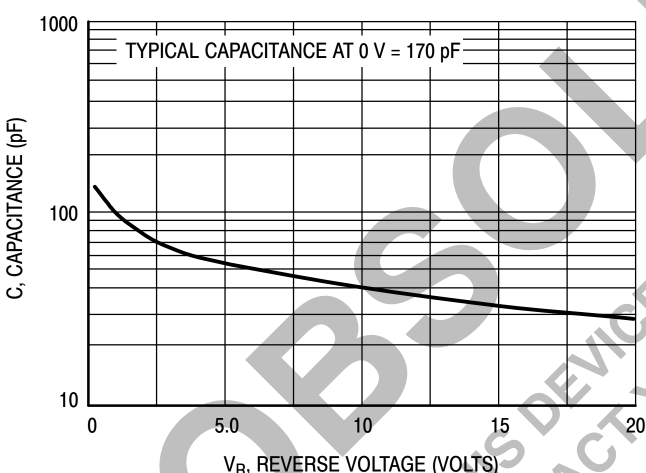


Figure 19. Typical Capacitance

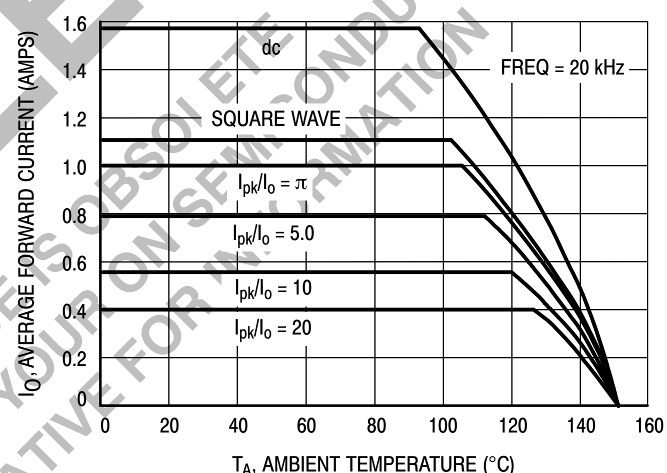


Figure 20. Current Derating

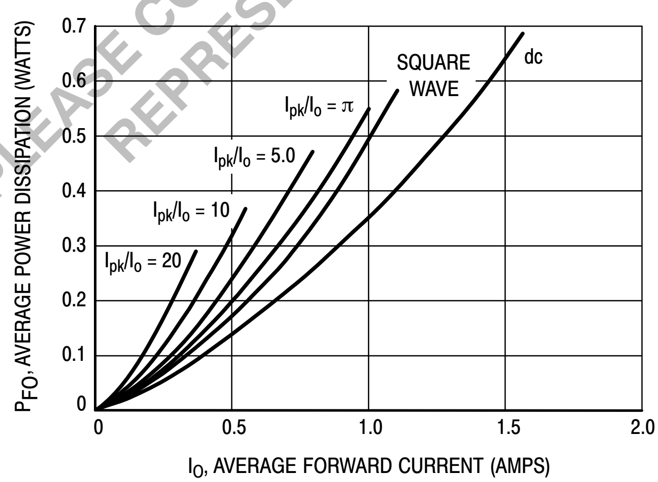


Figure 21. Forward Power Dissipation

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

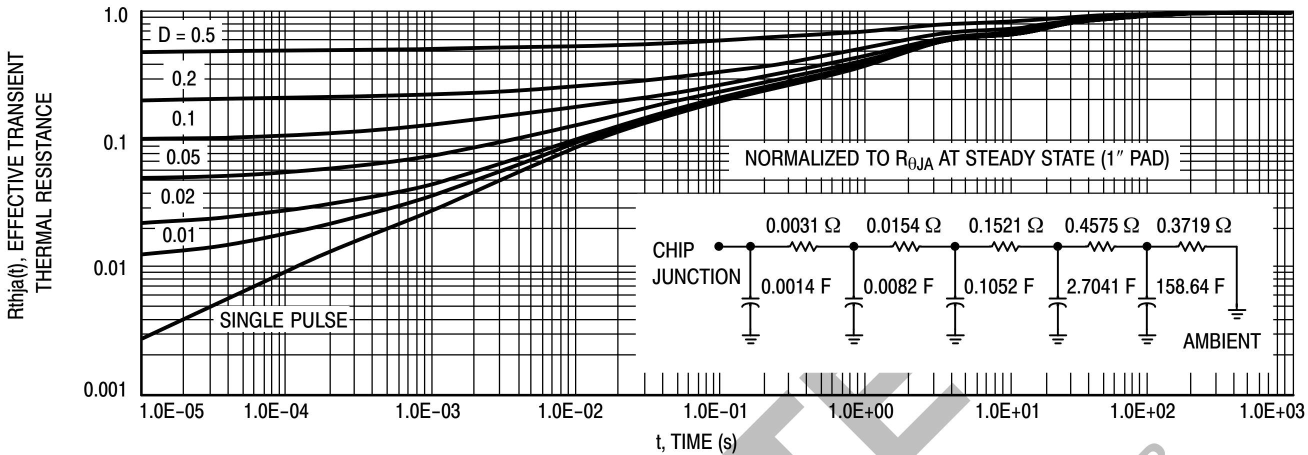
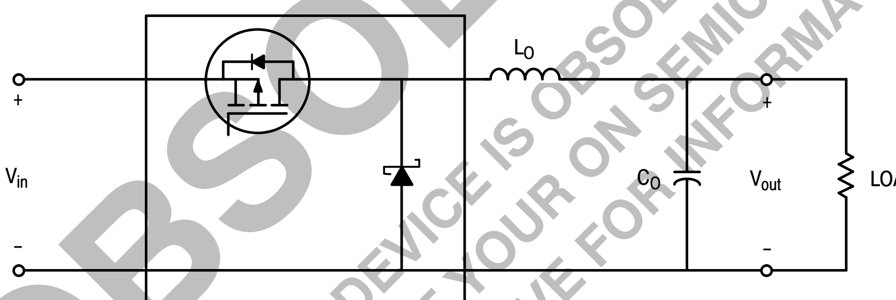


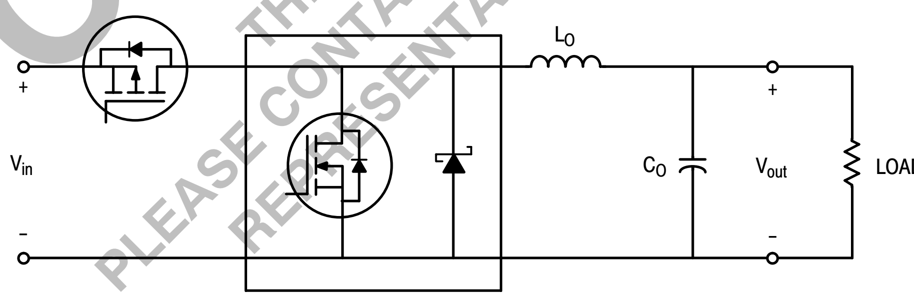
Figure 22. Schottky Thermal Response

TYPICAL APPLICATIONS

STEP DOWN SWITCHING REGULATORS



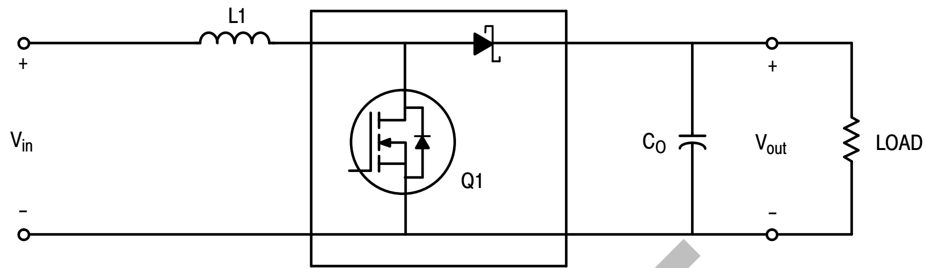
Buck Regulator



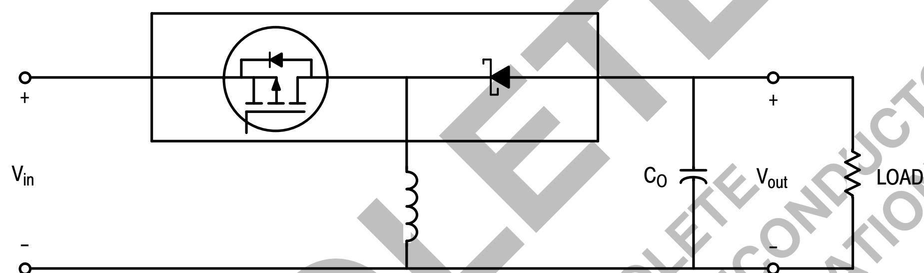
Synchronous Buck Regulator

TYPICAL APPLICATIONS

STEP UP SWITCHING REGULATORS



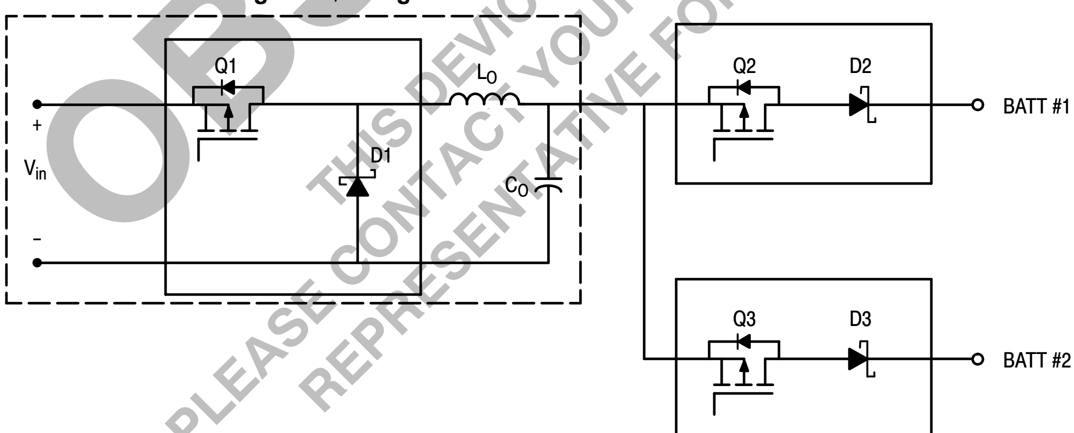
Boost Regulator



Buck−Boost Regulator

MULTIPLE BATTERY CHARGERS

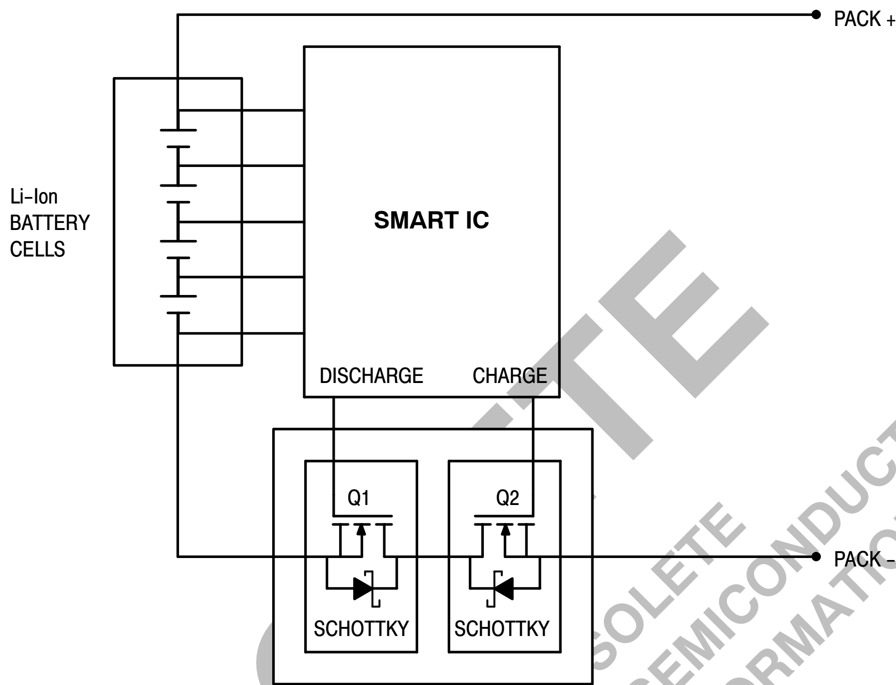
Buck Regulator/Charger



TYPICAL APPLICATIONS

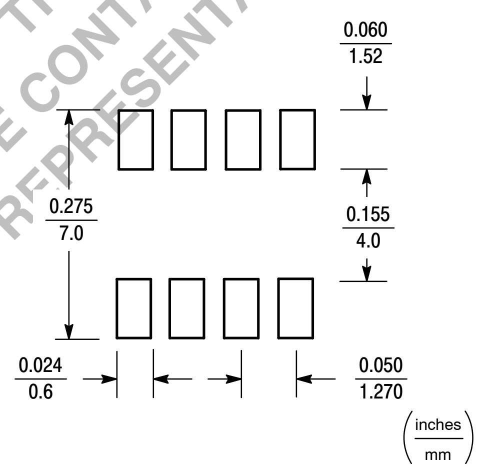
Li−Ion BATTERY PACK APPLICATIONS

Battery Pack



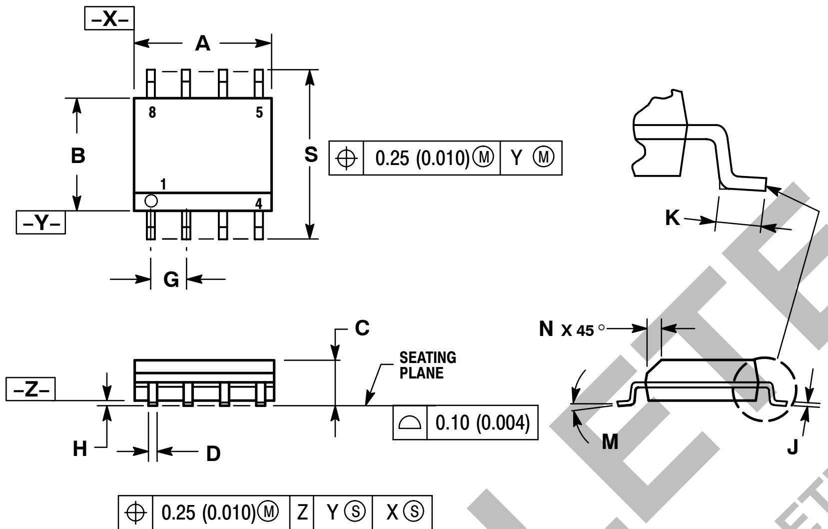
- Applicable in battery packs which require a high current level.
- During charge cycle Q2 is on and Q1 is off. Schottky can reduce power loss during fast charge.
- During discharge Q1 is on and Q2 is off. Again, Schottky can reduce power dissipation.
- Under normal operation, both transistors are on.

SO−8 FOOTPRINT



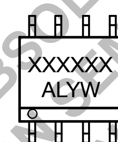
PACKAGE DIMENSIONS

SO−8
CASE 751−07
ISSUE V



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244



STYLE 18:
PIN 1. ANODE
2. ANODE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. CATHODE
8. CATHODE

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