MMDFS3P303

Power MOSFET
3 Amps, 30 Volts

P–Channel SO–8, FETKY™

The FETKY product family incorporates low $R_{DS(on)}$, 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
- R2 Suffix for Tape and Reel (2500 units/13″ reel)
- Mounting Information for SO–8 Package Provided
- I_{DSS} Specified at Elevated Temperature
- Applications Information Provided
- Marking: 3P303

MOSFET MAXIMUM RATINGS (T_J = 25°C unless otherwise noted) (Notes 1. & 2.)

Rating	Symbol	Value	Unit
Drain–to–Source Voltage	V_{DSS}	30	Vdc
Drain–to–Gate Voltage (R_{GS} = 1.0 MΩ)	V_{DGR}	30	Vdc
Gate–to–Source Voltage – Continuous	V_{GS}	±20	Vdc
Drain Current – Continuous @ T_A = 25°C – Continuous @ T_A = 100°C – Single Pulse (tp ≤ 10 μs)	 I_D I_D I_{DM}	 3.5 2.25 12	 Adc Apk
Total Power Dissipation @ T_A = 25°C (Note 3.)	P_D	2.0	Watts
Single Pulse Drain–to–Source Avalanche Energy – STARTING T_J = 25°C V_{DD} = 30 Vdc, V_{GS} = 10 Vdc, V_{DS} = 20 Vdc, I_L = 9.0 Apk, L = 10 mH, R_G = 25 Ω	E_{AS}	375	mJ

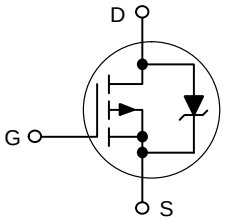
1. Negative sign for P–channel device omitted for clarity.
2. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.
3. Mounted on 2″ square FR4 board (1″ sq. 2 oz. Cu 0.06″ thick single sided), 10 sec. max.

ON Semiconductor™

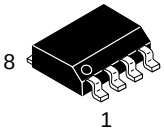
http://onsemi.com

3 AMPERES
30 VOLTS
$R_{DS(on)}$ = 100 mΩ
V_F = 0.42 Volts

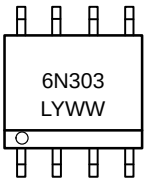
P–Channel



MARKING DIAGRAM

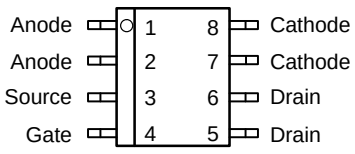


SO–8
CASE 751
STYLE 18



L = Location Code
Y = Year
WW = Work Week

PIN ASSIGNMENT



Top View

ORDERING INFORMATION

Device	Package	Shipping
MMDFS3P303R2	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	30	Volts
Average Forward Current (Note 3.) (Rated V_R) T_A = 100°C	I_O	3.0	Amps
Peak Repetitive Forward Current (Note 3.) (Rated V_R, Square Wave, 20 kHz) T_A = 105°C	I_{frm}	6.0	Amps
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{fsm}	30	Amps

THERMAL CHARACTERISTICS – SCHOTTKY AND MOSFET

Thermal Resistance – Junction–to–Ambient (Note 4.) – MOSFET	$R_{\theta JA}$	201	°C/W
Thermal Resistance – Junction–to–Ambient (Note 5.) – MOSFET	$R_{\theta JA}$	105	
Thermal Resistance – Junction–to–Ambient (Note 3.) – MOSFET	$R_{\theta JA}$	62.5	
Thermal Resistance – Junction–to–Ambient (Note 4.) – Schottky	$R_{\theta JA}$	197	
Thermal Resistance – Junction–to–Ambient (Note 5.) – Schottky	$R_{\theta JA}$	97	
Thermal Resistance – Junction–to–Ambient (Note 3.) – Schottky	$R_{\theta JA}$	62.5	
Operating and Storage Temperature Range	T_j, T_{stg}	–55 to 150	°C

3. Mounted on 2″ square FR4 board (1″ sq. 2 oz. Cu 0.06″ thick single sided), 10 sec. max.
4. Mounted with minimum recommended pad size, PC Board FR4.
5. 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) (Notes 1. & 6.)

Characteristics		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain–Source Voltage	(V_{GS} = 0 Vdc, I_D = 0.25 mA) Temperature Coefficient (Positive)	$V_{(BR)DSS}$	30 –	– 27	– –	Vdc mV/°C
Zero Gate Drain Current	(V_{DS} = 30 Vdc, V_{GS} = 0 Vdc) (V_{DS} = 30 Vdc, V_{GS} = 0 Vdc, T_J = 125°C)	I_{DSS}	– –	– –	1.0 10	μAdc
Gate Body Leakage Current	(V_{GS} = ± 20 Vdc, V_{DS} = 0)	I_{GSS}	–	–	100	nAdc
ON CHARACTERISTICS (Note 6.)						
Gate Threshold Voltage	(V_{DS} = V_{GS}, I_D = 0.25 mA) Temperature Coefficient (Negative)	$V_{GS(th)}$	1.0 –	1.7 3.5	– –	Vdc mV/°C
Static Drain–Source Resistance	(V_{GS} = 10 Vdc, I_D = 3.5 Adc) (V_{GS} = 4.5 Vdc, I_D = 2.0 Adc)	$R_{DS(on)}$	– –	0.085 0.130	0.100 0.160	Ω
Forward Transconductance (V_{DS} = 15 Vdc, I_D = 3.5 Adc)		g_{FS}	–	5.0	–	mhos
DYNAMIC CHARACTERISTICS						
Input Capacitance	(V_{DS} = 25 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{iss}	–	405	–	pF
Output Capacitance		C_{oss}	–	200	–	
Reverse Transfer Capacitance		C_{rss}	–	55	–	
SWITCHING CHARACTERISTICS (Note 7.)						
Turn–On Delay Time	(V_{DD} = 20 Vdc, I_D = 2.0 Adc, V_{GS} = 10 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	–	12.5	25	ns
Rise Time		t_r	–	16	30	
Turn–Off Delay Time		$t_{d(off)}$	–	50	90	
Fall Time		t_f	–	35	65	

1. Negative signs for P–Channel device omitted for clarity.
6. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
7. Switching characteristics are independent of operating junction temperature.

MOSFET ELECTRICAL CHARACTERISTICS – continued (T_J = 25°C unless otherwise noted) (Notes 1. & 6.)

Characteristics		Symbol	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS – continued (Note 7.)						
Turn–On Delay Time	(V_{DD} = 20 Vdc, I_D = 2.0 Adc, V_{GS} = 4.5 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	–	19	–	ns
Rise Time		t_r	–	36	–	
Turn–Off Delay Time		$t_{d(off)}$	–	27	–	
Fall Time		t_f	–	31	–	
Gate Charge	(V_{DS} = 20 Vdc, I_D = 3.5 Adc, V_{GS} = 10 Vdc)	Q_T	–	14	25	nC
		Q_1	–	1.8	–	
		Q_2	–	4.5	–	
		Q_3	–	2.85	–	
DRAIN SOURCE DIODE CHARACTERISTICS						
Forward On–Voltage (Note 6.)	(I_S = 1.7 Adc, V_{GS} = 0 Vdc)	V_{SD}	–	0.9	1.2	V
Reverse Recovery Time	(V_{GS} = 0 V, I_S = 3.5 A, dIS/dt = 100 A/μs)	t_{rr}	–	26.6	–	ns
		t_a	–	18.8	–	
		t_b	–	7.8	–	
Reverse Recovery Stored Charge		Q_{RR}	–	0.03	–	μC

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

Maximum Instantaneous Forward Voltage (Note 6.)	V_F	**T_J = 25°C**	**T_J = 125°C**	Volts
I_F = 100 mAdc		0.28	0.13	
I_F = 3.0 Adc		0.42	0.33	
I_F = 6.0 Adc		0.50	0.45	
Maximum Instantaneous Reverse Current (Note 6.)	I_R	**T_J = 25°C**	**T_J = 125°C**	μA
V_R = 30 V		250	–	
		–	25	mA
Maximum Voltage Rate of Change V_R = 30 V	dV/dt	10,000		V/μs

1. Negative signs for P–Channel device omitted for clarity.
6. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
7. Switching characteristics are independent of operating junction temperature.

TYPICAL FET ELECTRICAL CHARACTERISTICS

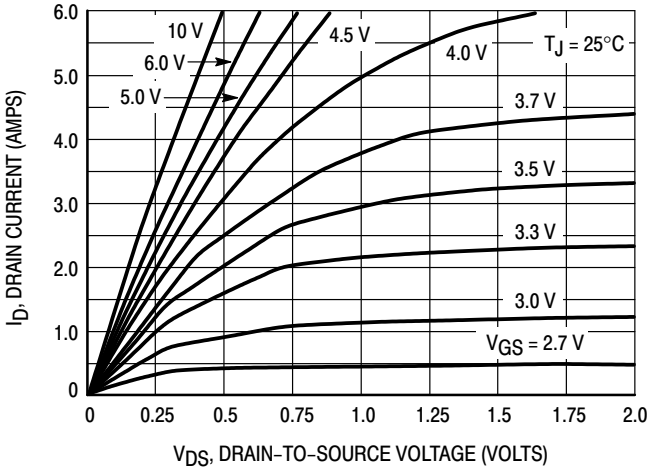


Figure 1. On−Region Characteristics

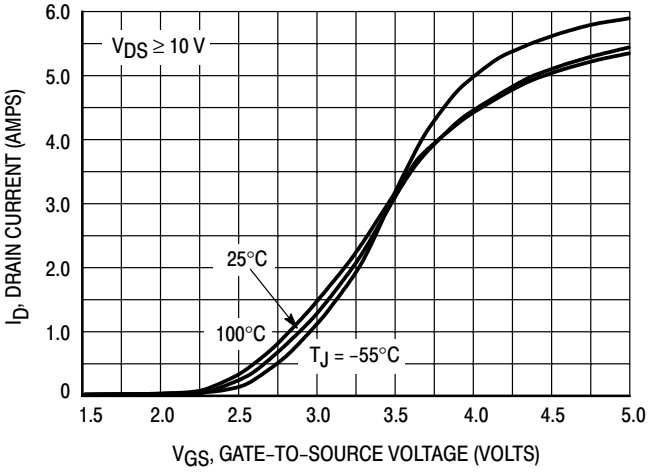


Figure 2. Transfer Characteristics

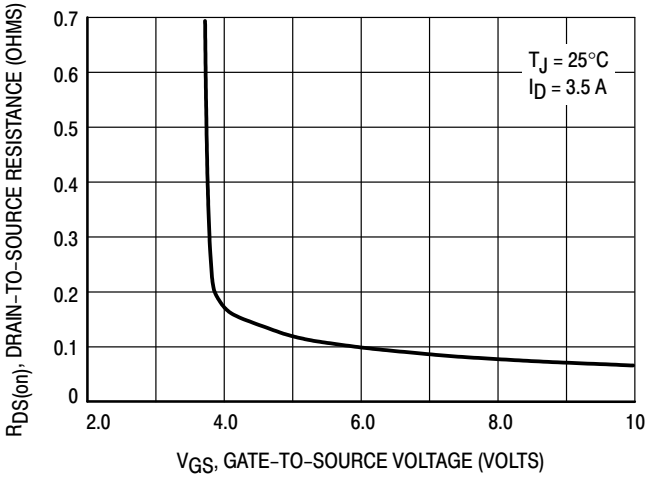


Figure 3. On−Resistance versus Gate−To−Source Voltage

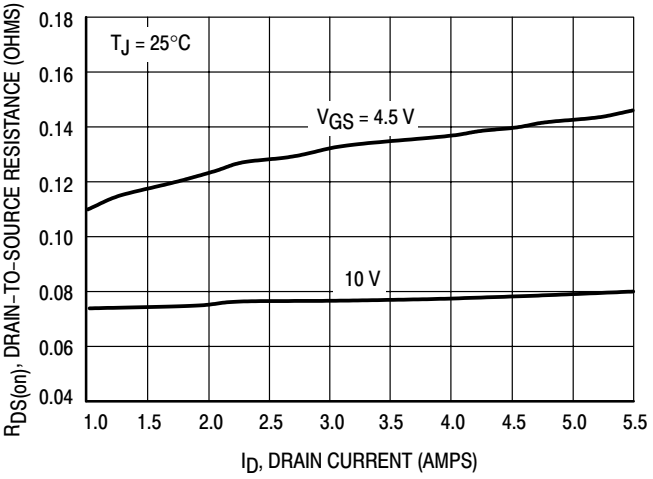


Figure 4. On−Resistance versus Drain Current and Gate Voltage

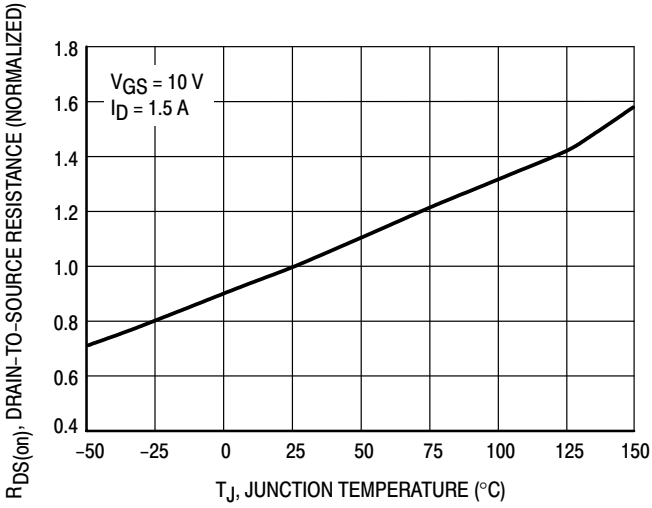


Figure 5. On−Resistance Variation with Temperature

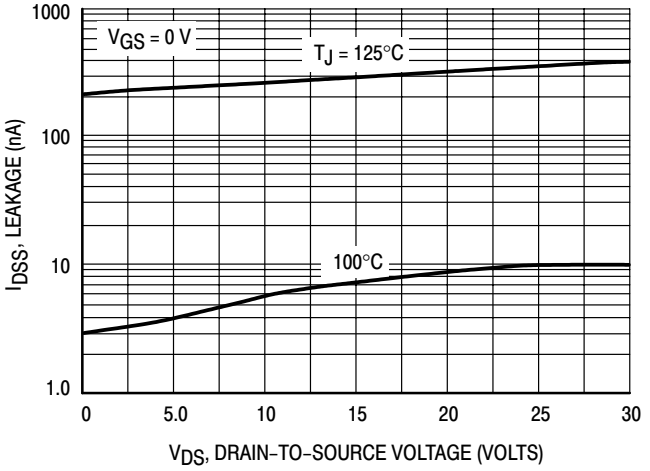


Figure 6. Drain−To−Source Leakage Current versus Voltage

TYPICAL FET ELECTRICAL CHARACTERISTICS

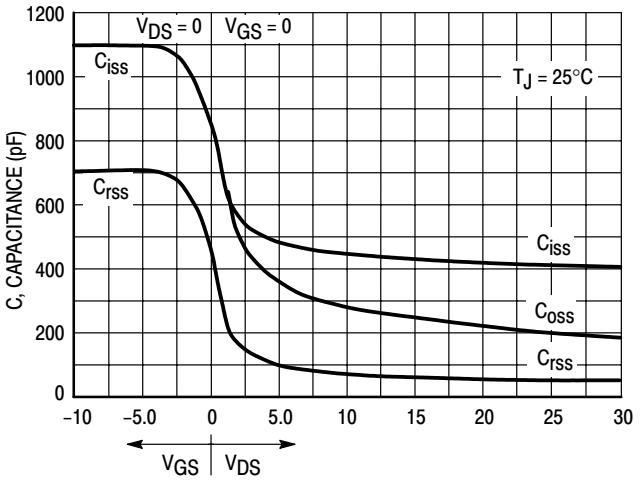


Figure 7. Capacitance Variation

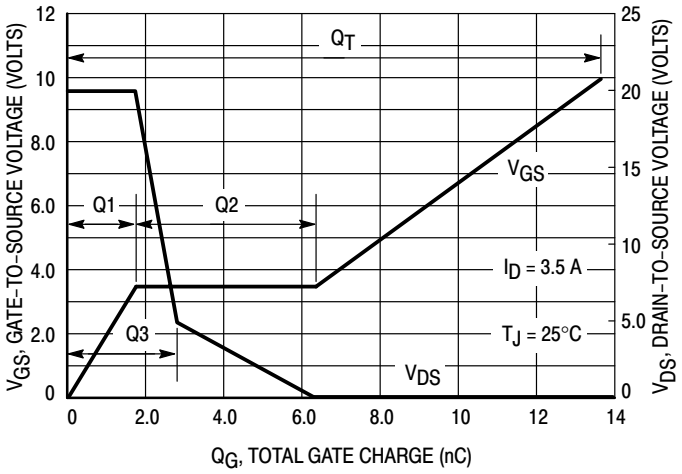


Figure 8. Gate−To−Source and Drain−To−Source Voltage versus Total Charge

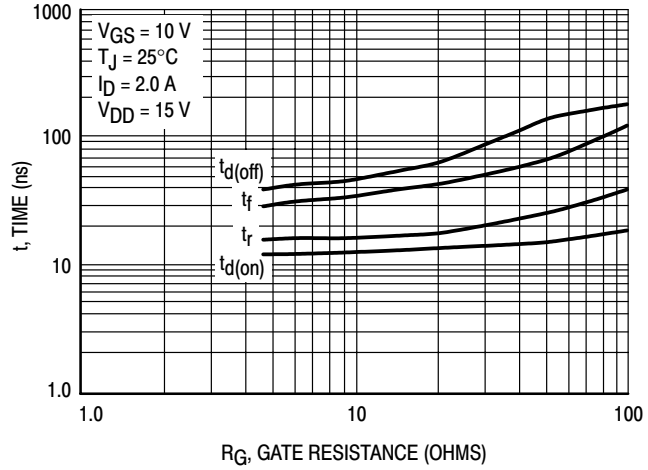


Figure 9. Resistive Switching Time Variation versus Gate Resistance

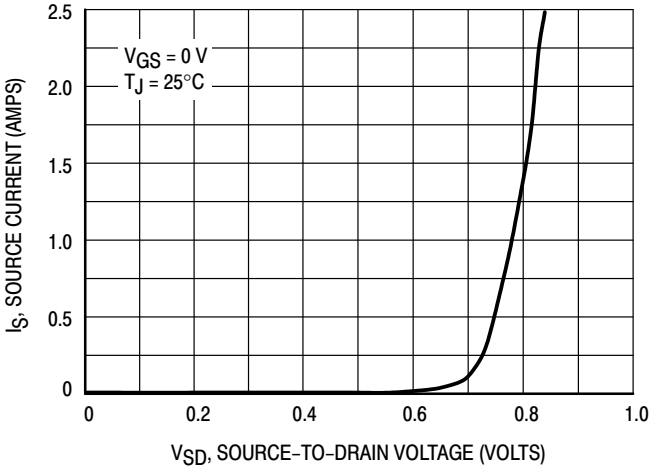


Figure 10. Diode Forward Voltage versus Current

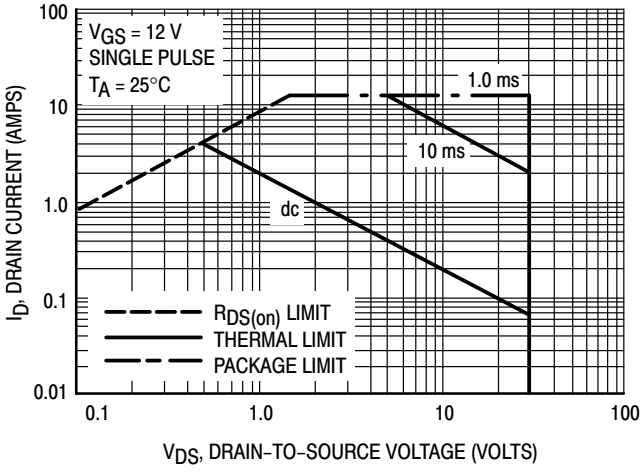


Figure 11. Maximum Rated Forward Biased Safe Operating Area

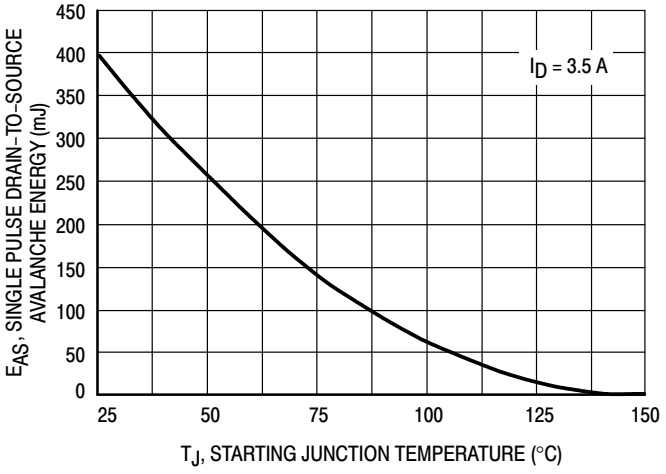


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

TYPICAL FET ELECTRICAL CHARACTERISTICS

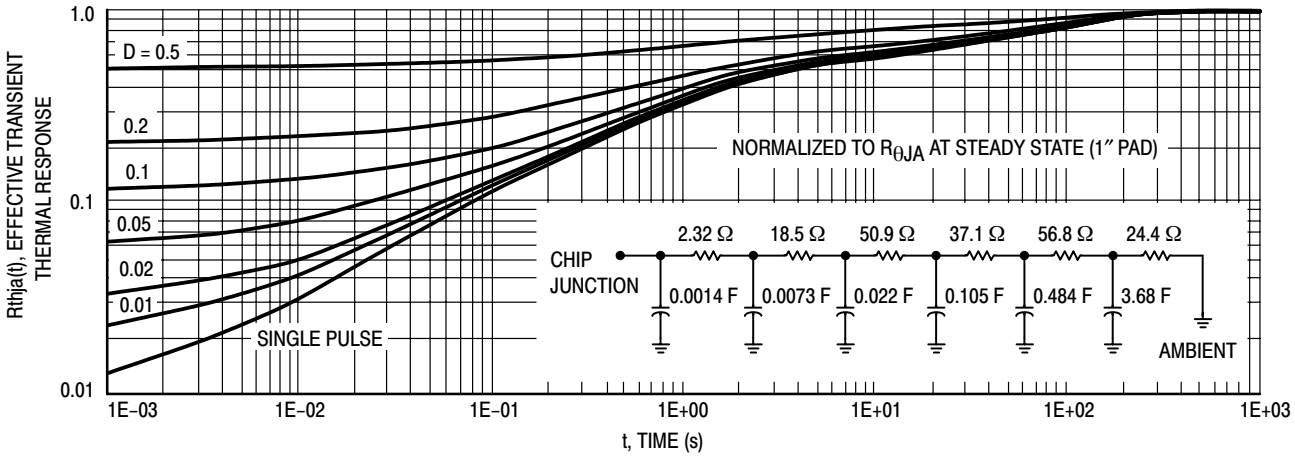


Figure 13. FET Thermal Response

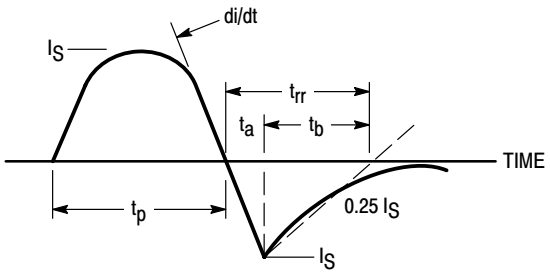


Figure 14. Diode Reverse Recovery Waveform

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

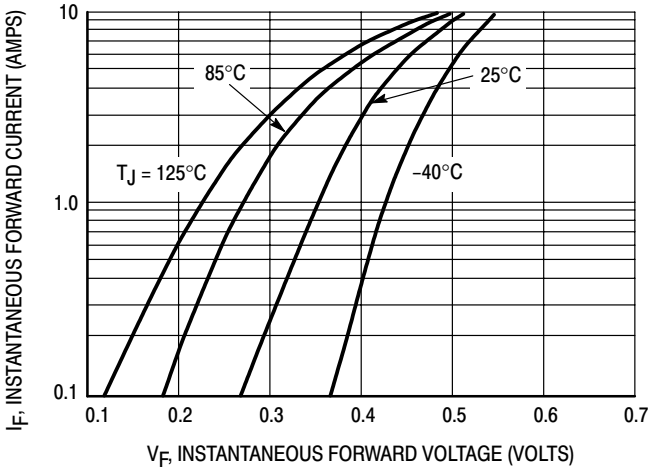


Figure 15. Typical Forward Voltage

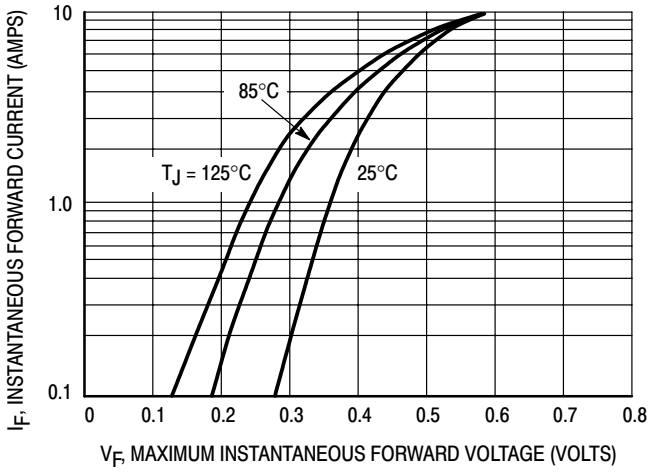


Figure 16. Maximum Forward Voltage

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

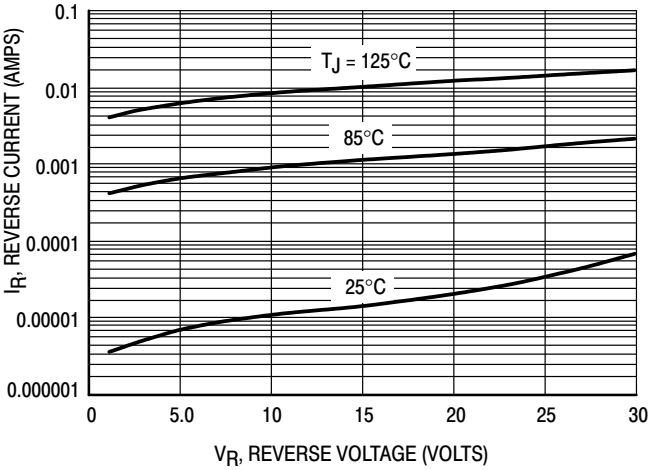


Figure 17. Typical Reverse Current

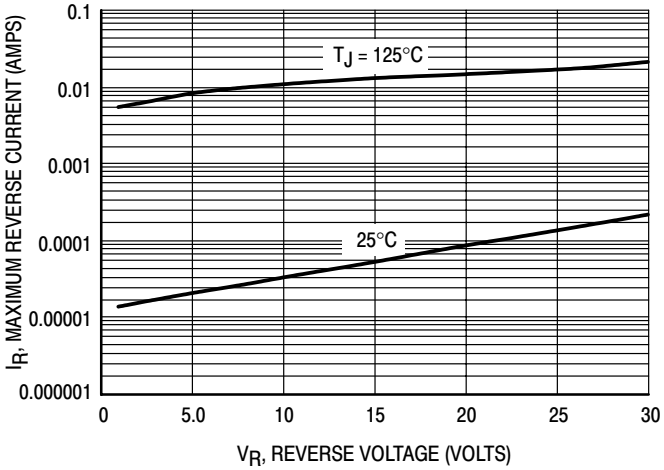


Figure 18. Maximum Reverse Current

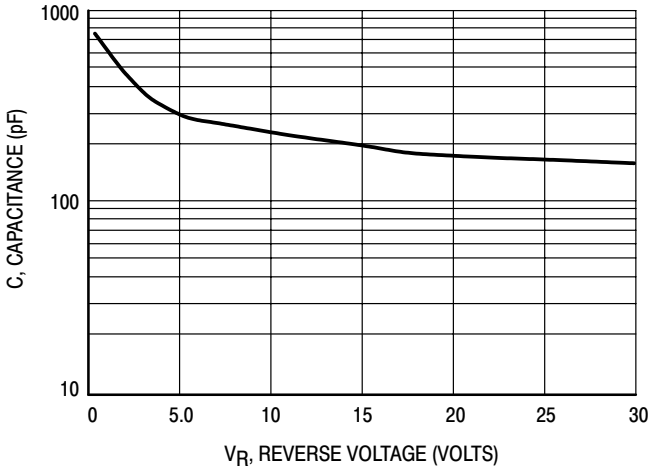


Figure 19. Typical Capacitance

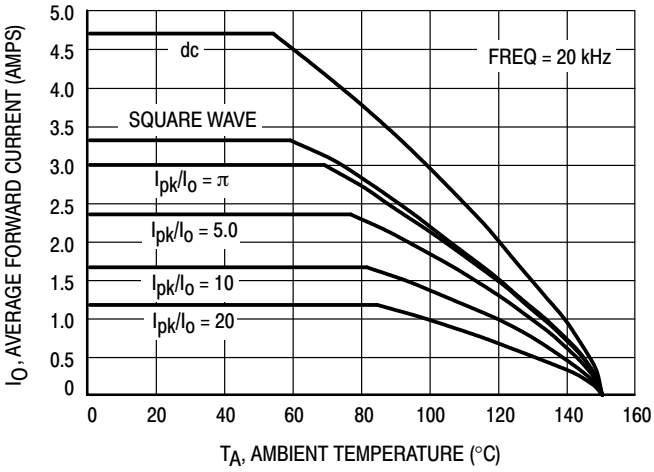


Figure 20. Current Derating

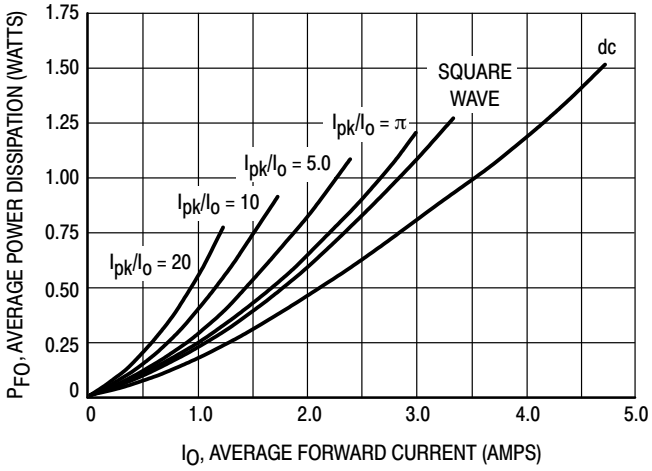


Figure 21. Forward Power Dissipation

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

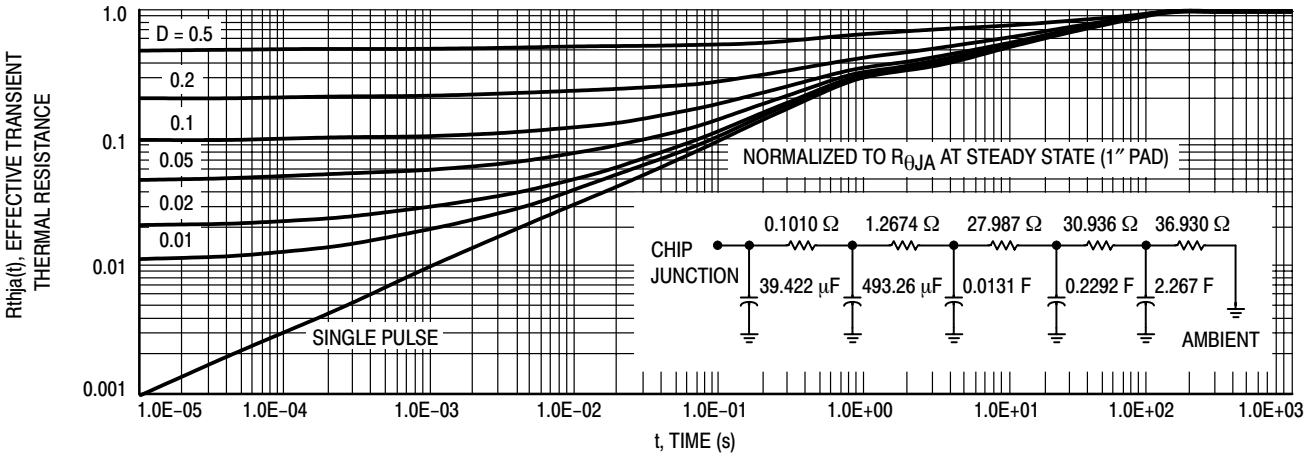
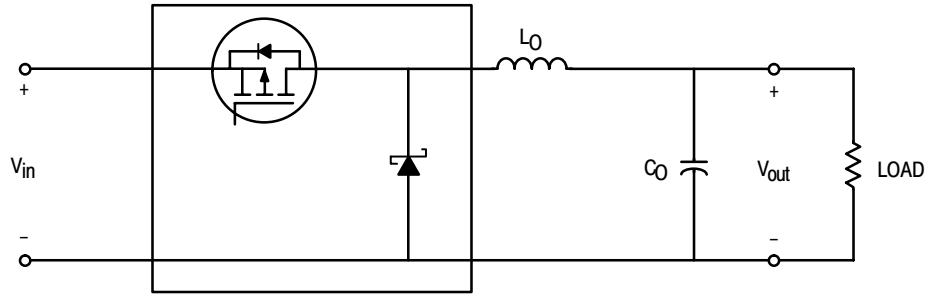


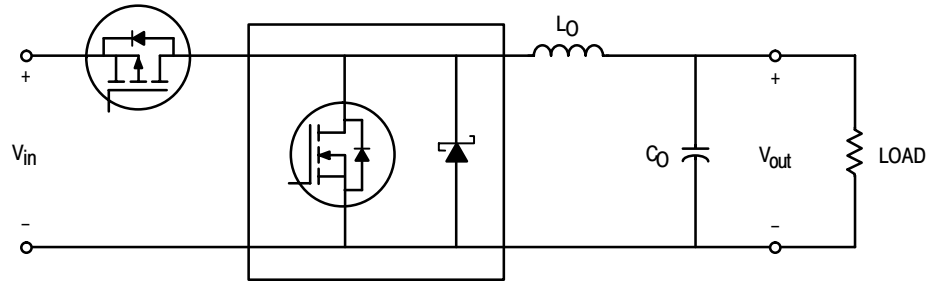
Figure 22. Schottky Thermal Response

TYPICAL APPLICATIONS

STEP DOWN SWITCHING REGULATORS



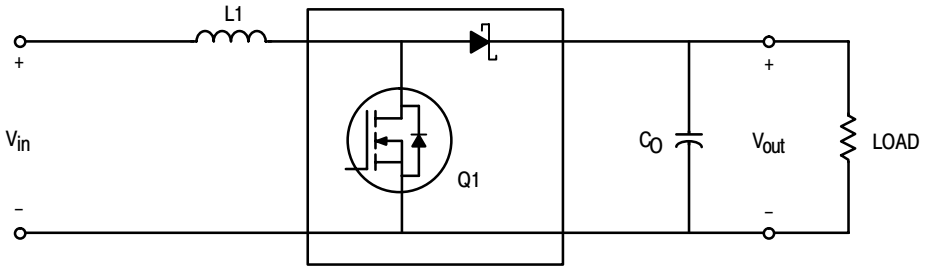
Buck Regulator



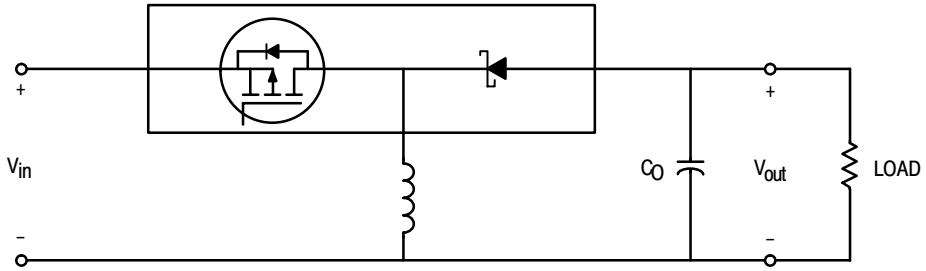
Synchronous Buck Regulator

TYPICAL APPLICATIONS

STEP UP SWITCHING REGULATORS

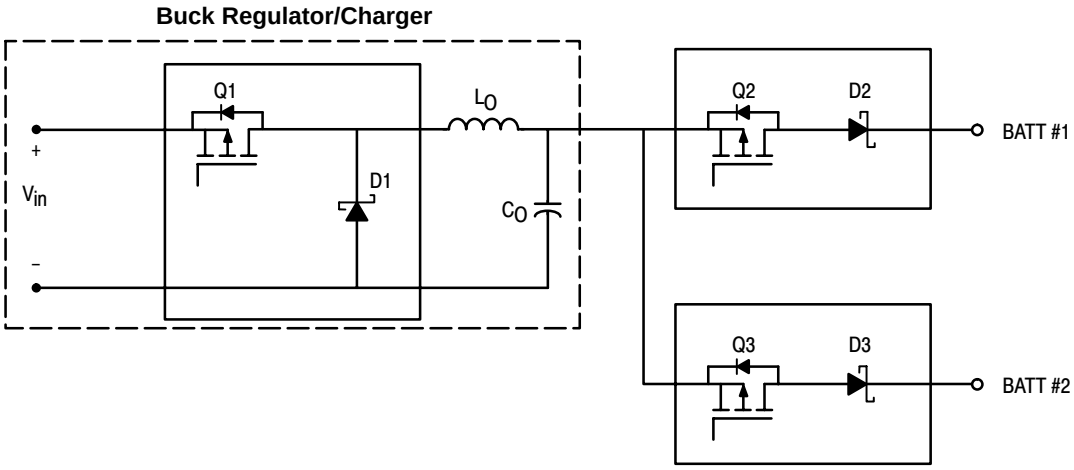


Boost Regulator



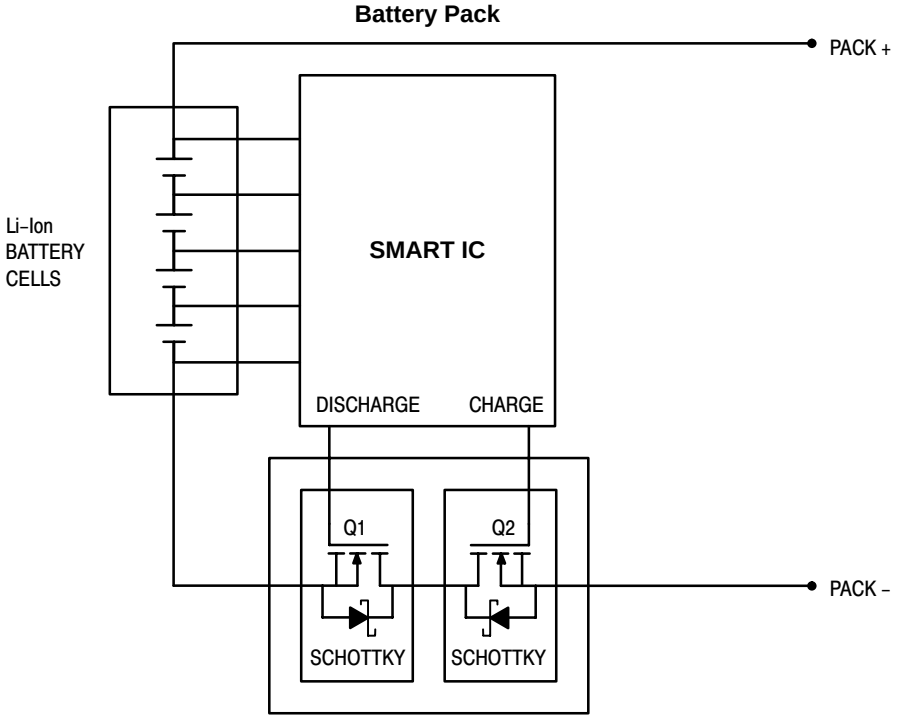
Buck–Boost Regulator

MULTIPLE BATTERY CHARGERS



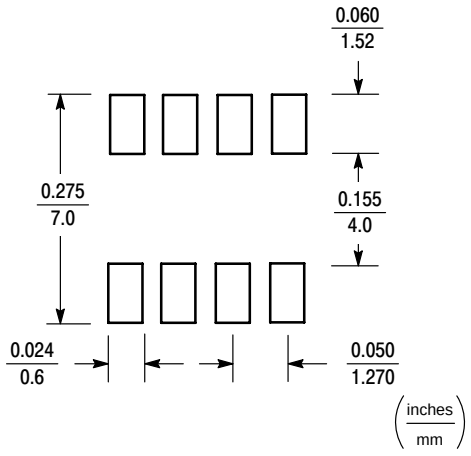
TYPICAL APPLICATIONS

Li–Ion BATTERY PACK APPLICATIONS



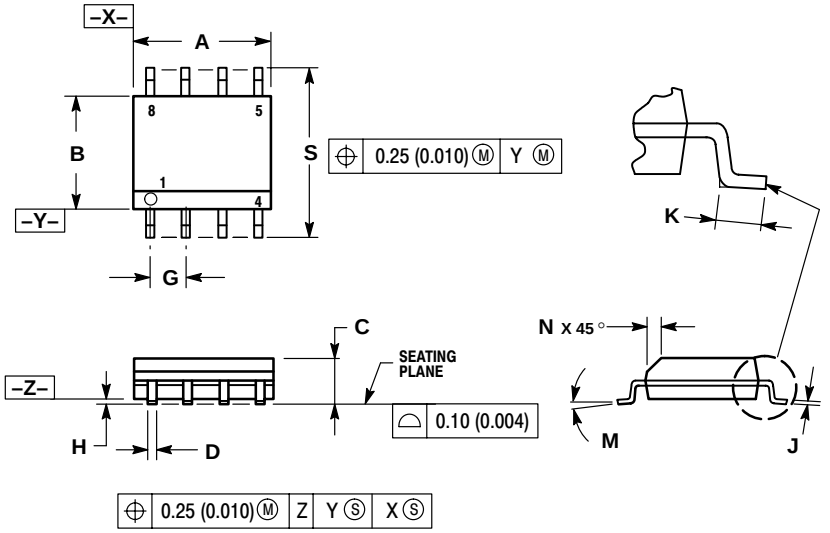
- Applicable in battery packs which require a high current level.
- During charge cycle Q2 is on and Q1 is off. Schottky can reduce power loss during fast charge.
- During discharge Q1 is on and Q2 is off. Again, Schottky can reduce power dissipation.
- Under normal operation, both transistors are on.

SO–8 FOOTPRINT



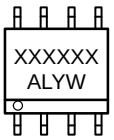
PACKAGE DIMENSIONS

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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