Product Preview

FETKY™

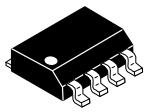
MOSFET and Schottky Rectifier

MMDFS3P303

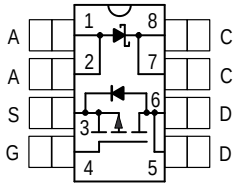
P–Channel Power MOSFET with Schottky Rectifier 30 Volts $R_{DS(on)}$ = 0.100 Ω V_F = 0.42 Volts

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 TMOS 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.

- HDTMOS 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



CASE 751–06, Style 18
(SO–8)



TOP VIEW

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

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 (3) (Rated V_R) T_A = 100°C	I_O	3.0	Amps
Peak Repetitive Forward Current (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

DEVICE MARKING

3P303

ORDERING INFORMATION

Device	Reel Size	Tape Width	Quantity
MMDFS3P303R2	13″	12 mm embossed tape	2500 units

(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.

This document contains information on a product under development. Motorola reserves the right to change or discontinue this product without notice.

HDTMOS is a trademark of Motorola, Inc. TMOS is a registered trademark of Motorola, Inc.
FETKY is a trademark of International Rectifier.

THERMAL CHARACTERISTICS — SCHOTTKY AND MOSFET

Thermal Resistance — Junction–to–Ambient (1) — MOSFET	$R_{\theta JA}$	201	°C/W
Thermal Resistance — Junction–to–Ambient (2) — MOSFET	$R_{\theta JA}$	105	
Thermal Resistance — Junction–to–Ambient (3) — MOSFET	$R_{\theta JA}$	62.5	
Thermal Resistance — Junction–to–Ambient (1) — Schottky	$R_{\theta JA}$	197	
Thermal Resistance — Junction–to–Ambient (2) — Schottky	$R_{\theta JA}$	97	
Thermal Resistance — Junction–to–Ambient (3) — Schottky	$R_{\theta JA}$	62.5	
Operating and Storage Temperature Range	T_j, T_{stg}	–55 to 150	°C

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

MOSFET ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (4) (5)

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 (5)						
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 (6)						
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	
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 (5)	(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 (5)	V_F	**T_J = 25°C**	**T_J = 125°C**	Volts
I_F = 100 mAdc I_F = 3.0 Adc I_F = 6.0 Adc		0.28 0.42 0.50	0.13 0.33 0.45	
Maximum Instantaneous Reverse Current (5)	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

(4) Negative sign for P–channel device omitted for clarity
(5) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
(6) Switching characteristics are independent of operating junction temperature.

TYPICAL FET ELECTRICAL CHARACTERISTICS

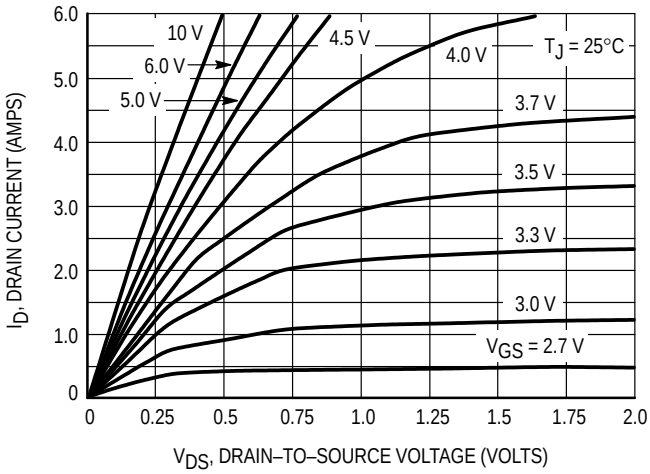


Figure 1. On–Region Characteristics

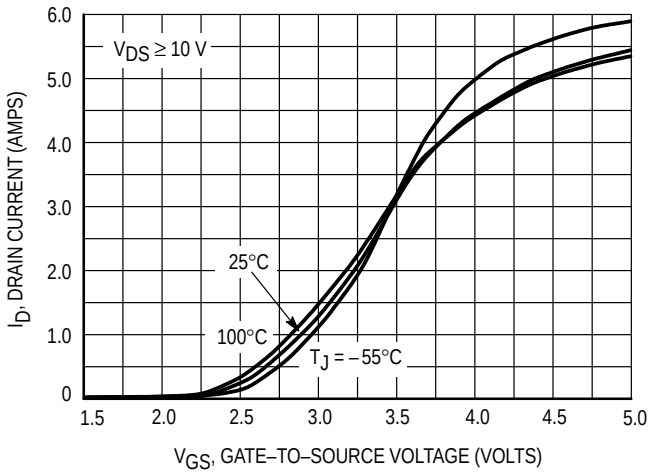


Figure 2. Transfer Characteristics

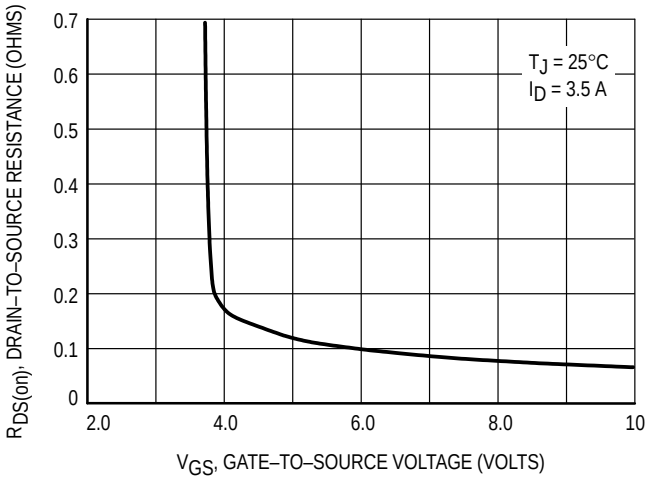


Figure 3. On–Resistance versus Gate–To–Source Voltage

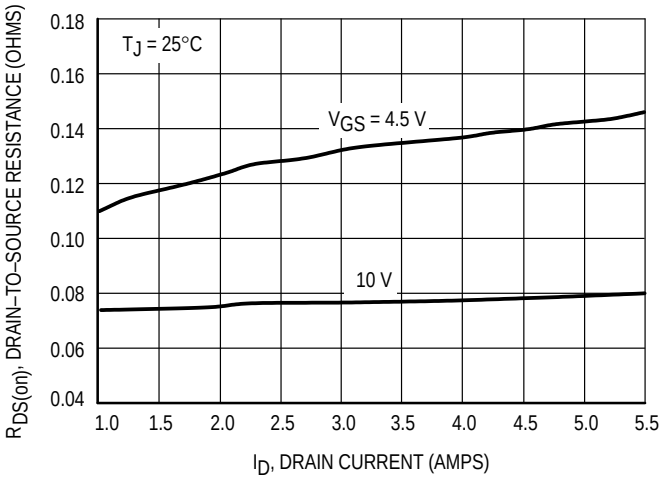


Figure 4. On–Resistance versus Drain Current and Gate Voltage

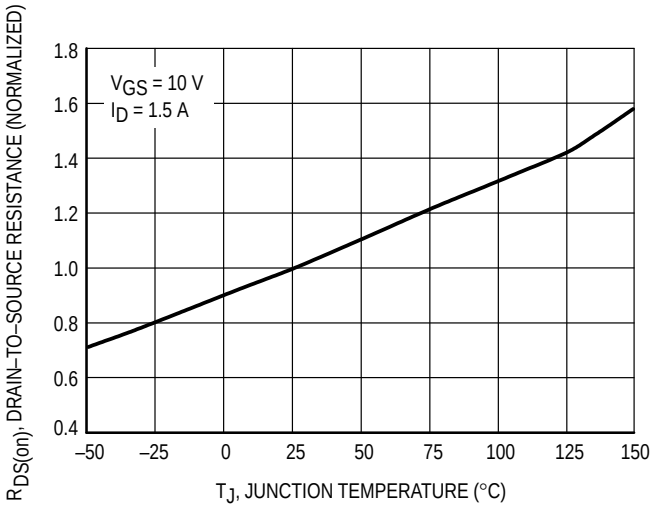


Figure 5. On–Resistance Variation with Temperature

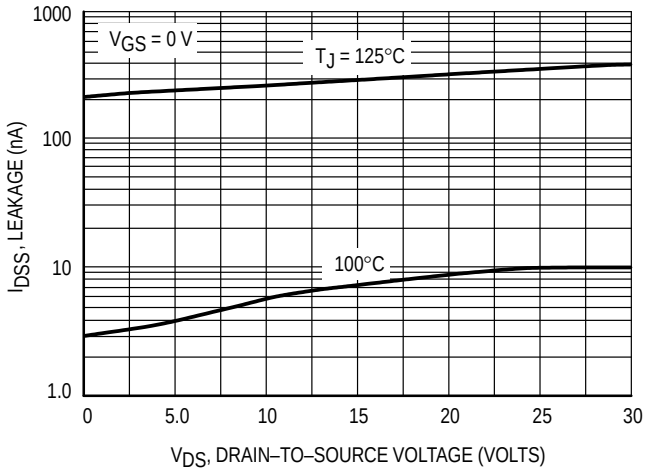


Figure 6. Drain–To–Source Leakage Current versus Voltage

TYPICAL FET ELECTRICAL CHARACTERISTICS

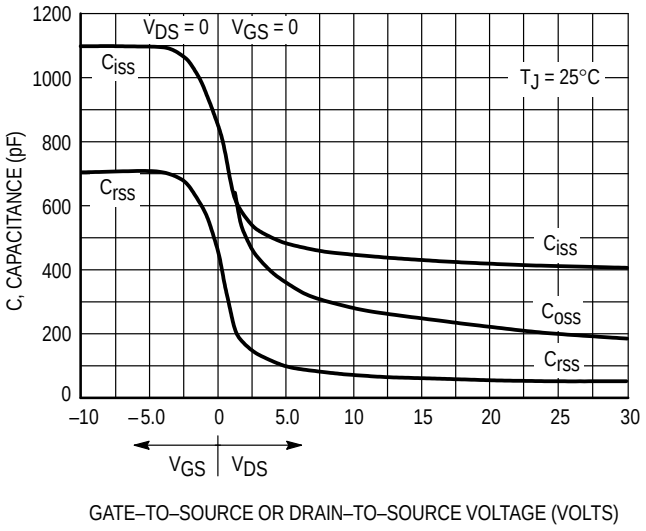


Figure 7. Capacitance Variation

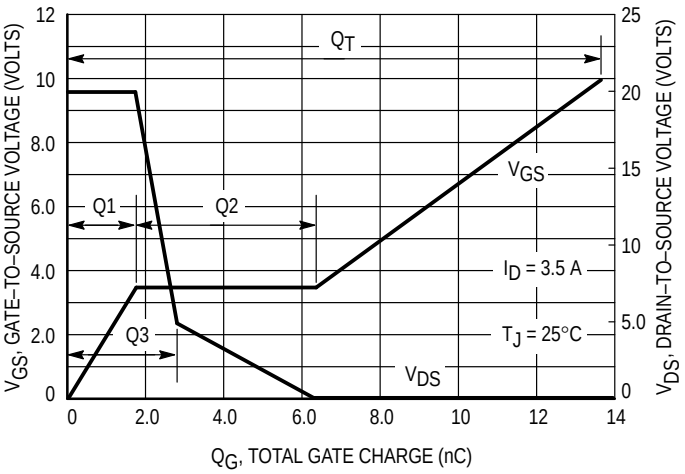


Figure 8. Gate–To–Source and Drain–To–Source Voltage versus Total Charge

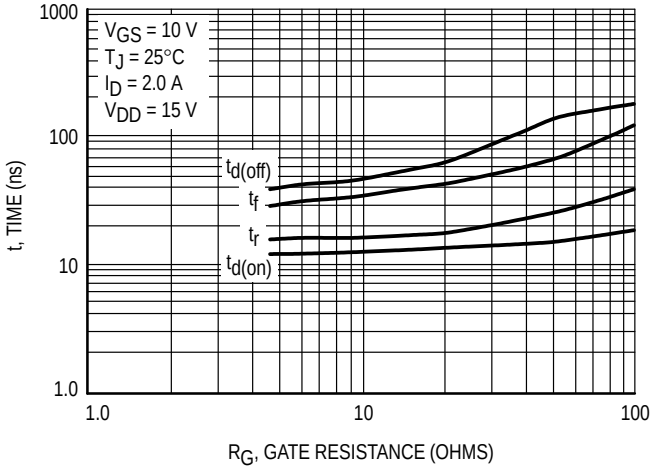


Figure 9. Resistive Switching Time Variation versus Gate Resistance

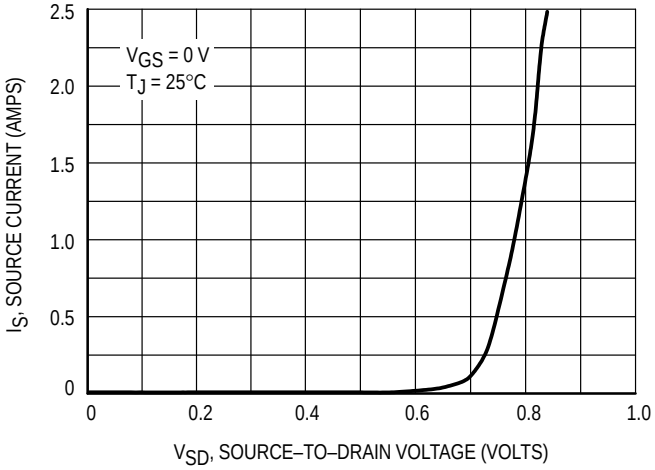


Figure 10. Diode Forward Voltage versus Current

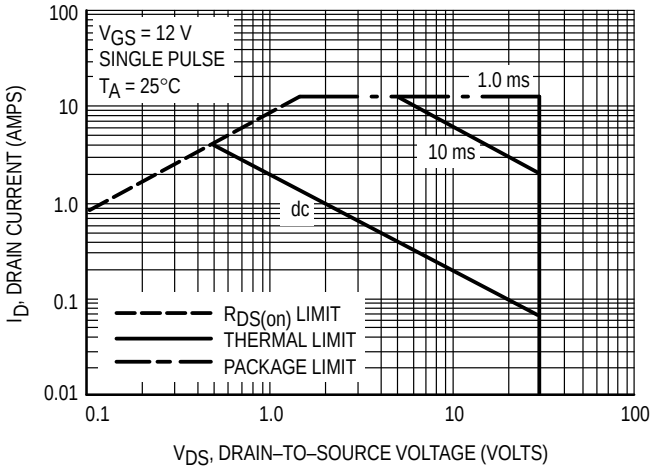


Figure 11. Maximum Rated Forward Biased Safe Operating Area

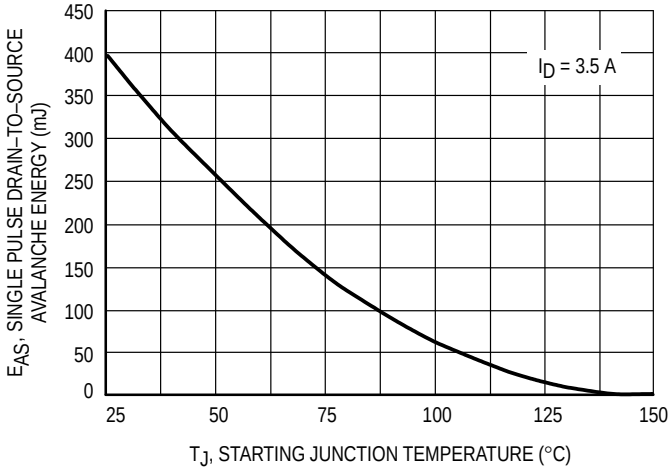


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

TYPICAL FET ELECTRICAL CHARACTERISTICS

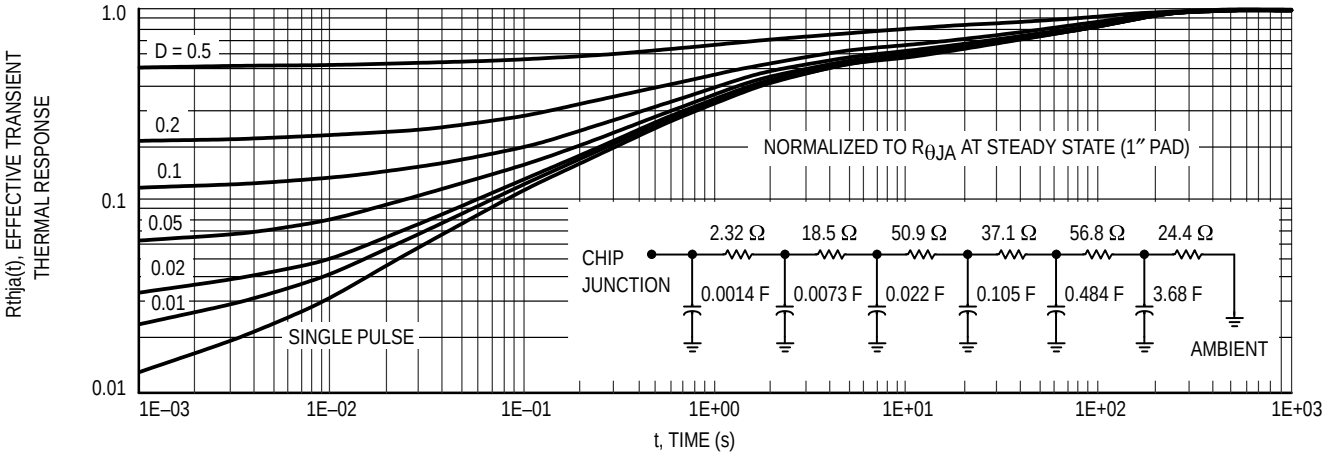


Figure 13. FET Thermal Response

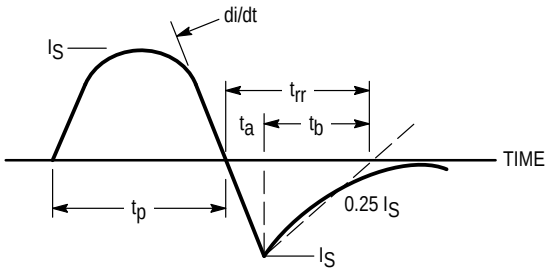


Figure 14. Diode Reverse Recovery Waveform

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

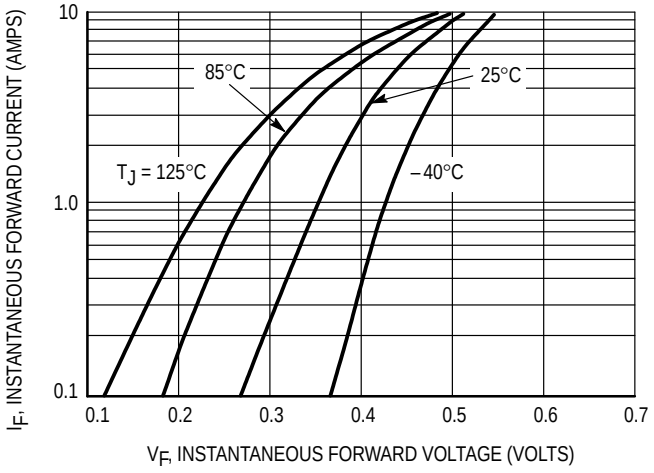


Figure 15. Typical Forward Voltage

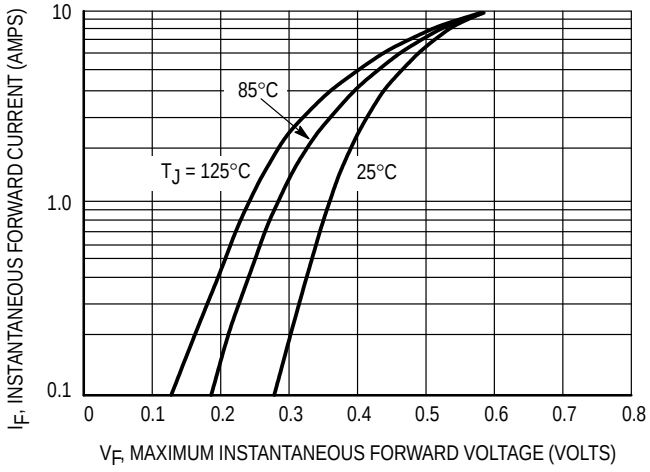


Figure 16. Maximum Forward Voltage

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

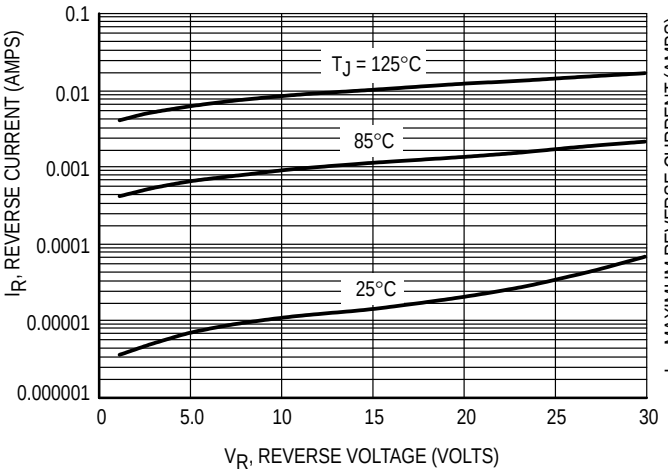


Figure 17. Typical Reverse Current

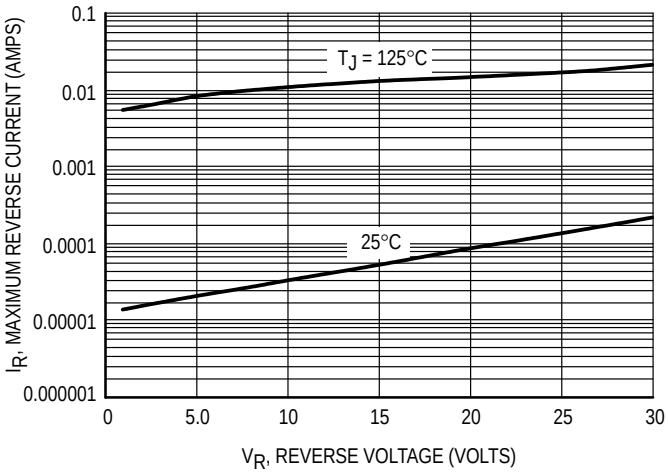


Figure 18. Maximum Reverse Current

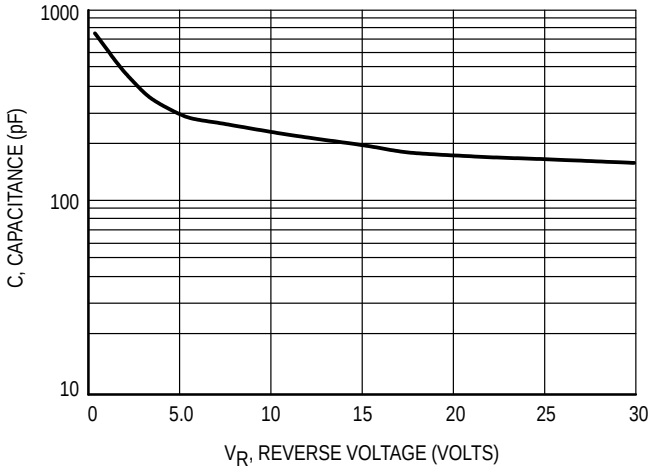


Figure 19. Typical Capacitance

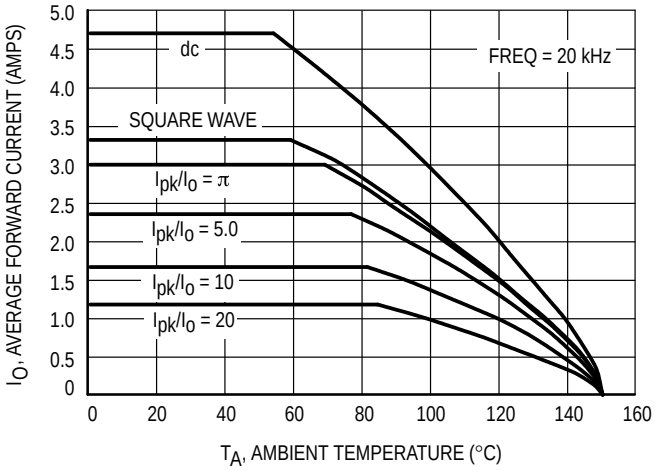


Figure 20. Current Derating

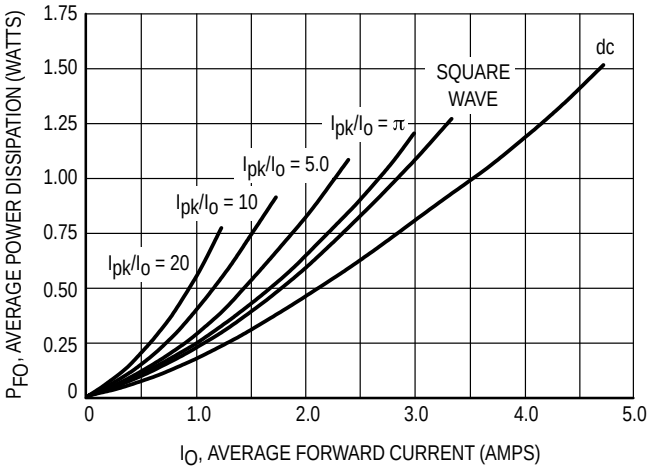


Figure 21. Forward Power Dissipation

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

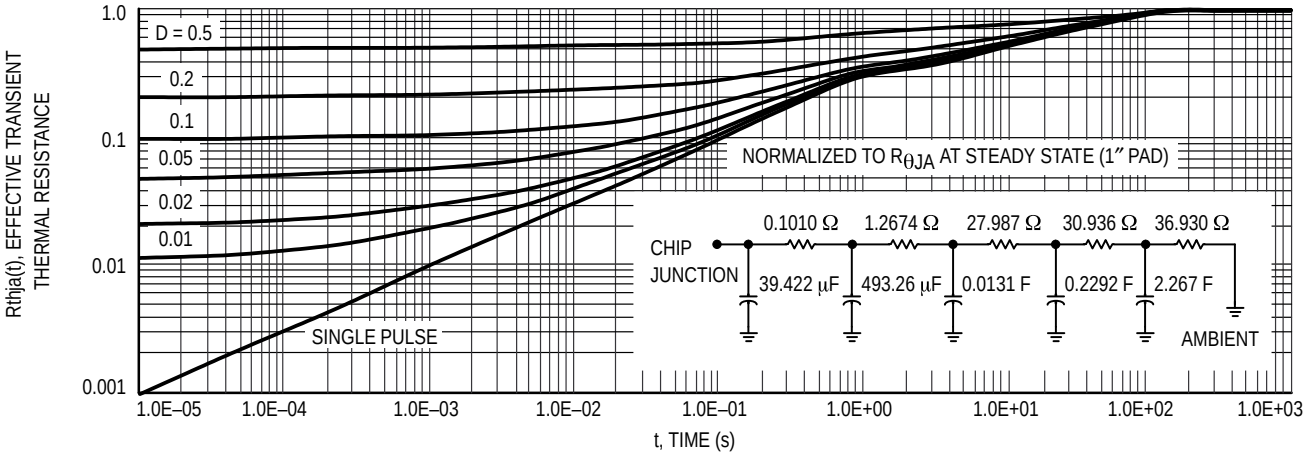
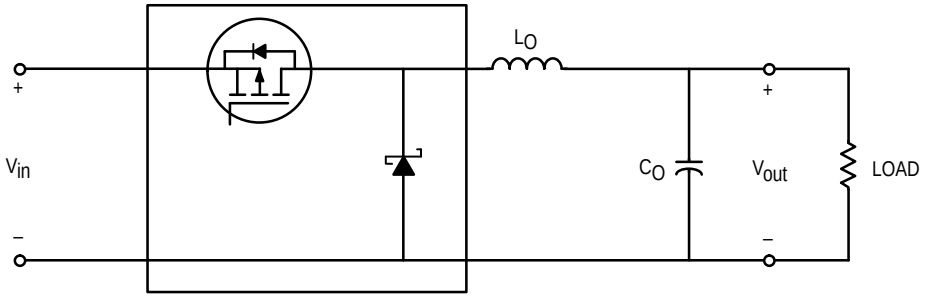


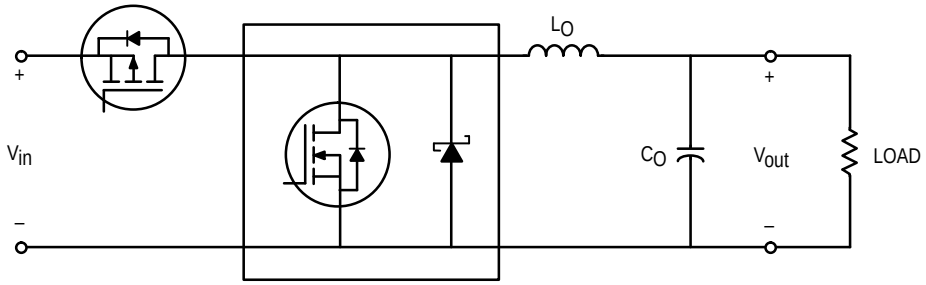
Figure 22. Schottky Thermal Response

TYPICAL APPLICATIONS

STEP DOWN SWITCHING REGULATORS

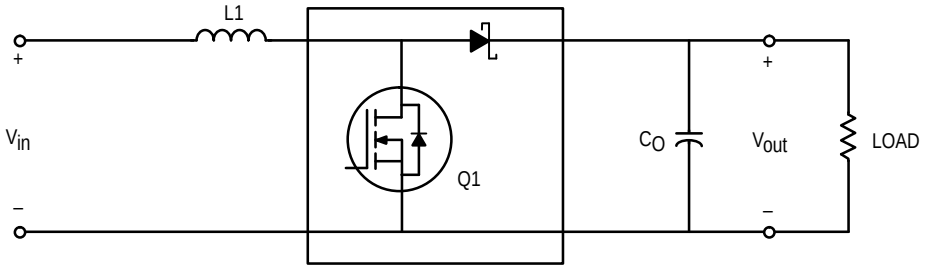


Buck Regulator

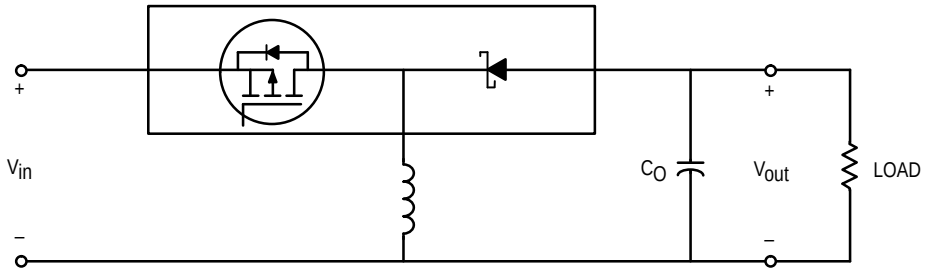


Synchronous Buck Regulator

STEP UP SWITCHING REGULATORS



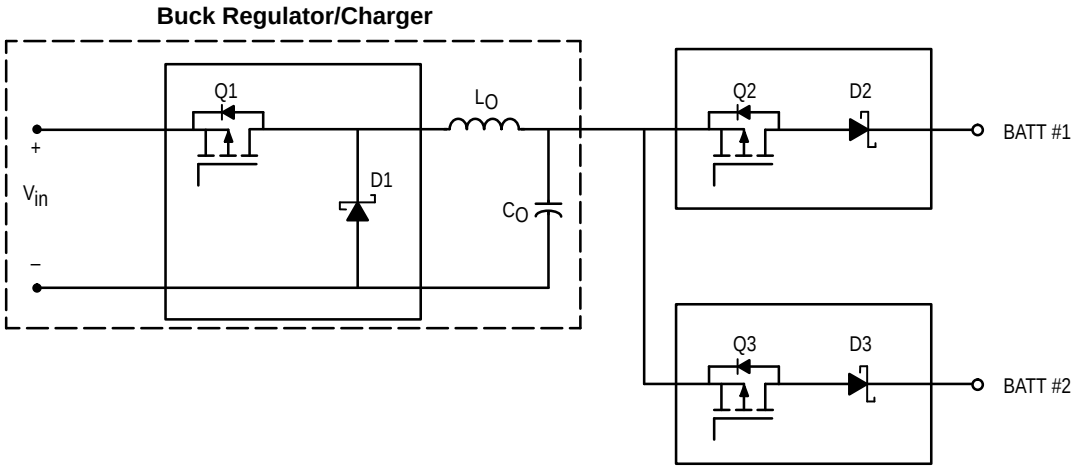
Boost Regulator



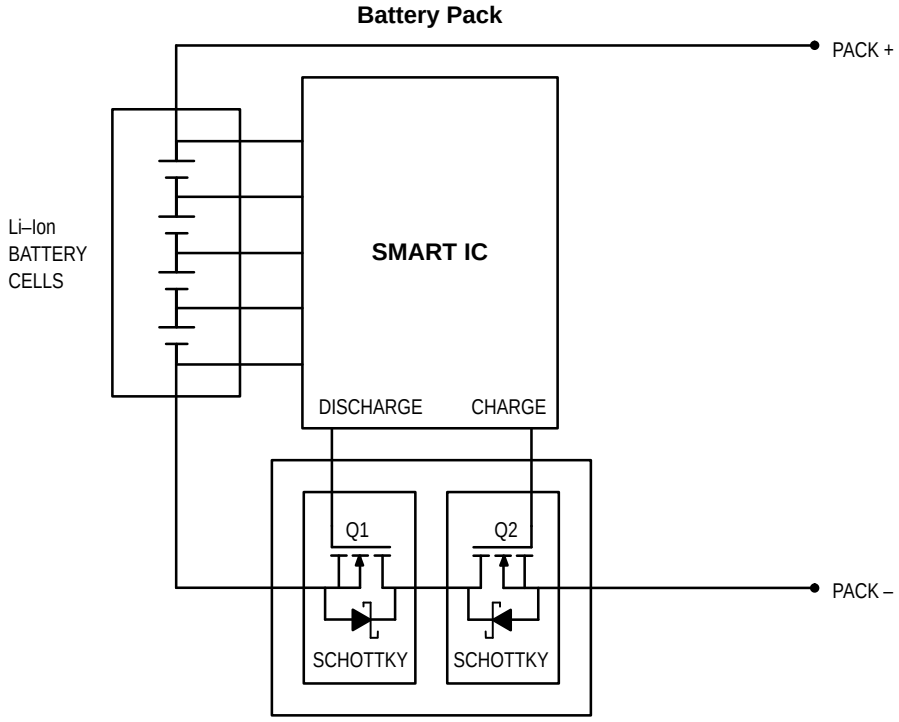
Buck–Boost Regulator

TYPICAL APPLICATIONS

MULTIPLE BATTERY CHARGERS

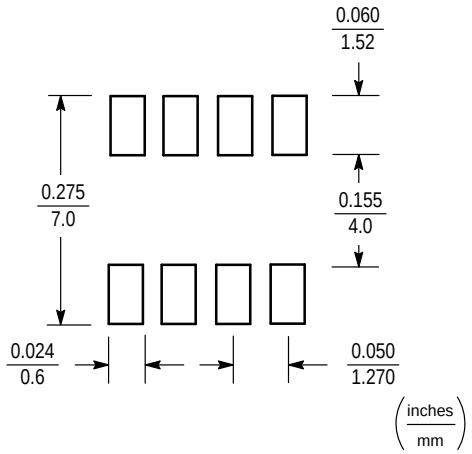


Li–Ion BATTERY PACK APPLICATIONS

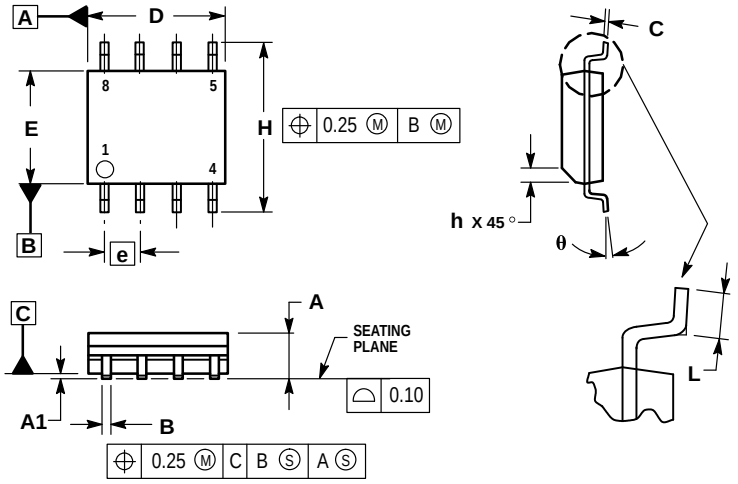


- Applicable in battery packs which require a high current level.
- During charge cycle Q2 is on and Q1 is off. Schottky can reduce power loss during fast charge.
- During discharge Q1 is on and Q2 is off. Again, Schottky can reduce power dissipation.
- Under normal operation, both transistors are on.

SO–8 FOOTPRINT



PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETER.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS	
DIM	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.35	0.49
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.25
θ	0°	7°

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

CASE 751–06
SO–08
ISSUE T

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