MMDFS6N303

Power MOSFET
6 Amps, 30 Volts

N−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.

Features

- Power MOSFET with Low V_F
- 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
- Applications Information Provided
- R2 Suffix for Tape and Reel (2500 units/13″ reel)
- Marking: 6N303

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

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 (Note 2) − Continuous @ T_A = 25°C − Single Pulse (tp ≤ 10 μs)	I_D I_{DM}	6.0 30	Adc Apk
Total Power Dissipation @ T_A = 25°C (Note 2)	P_D	2.0	Watts
Single Pulse Drain−to−Source Avalanche Energy — Startin 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}	325	mJ

1. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.
2. Mounted on 2″ square FR4 board (1″ sq. 2 oz. Cu 0.06″ thick single sided), 10 sec. max.

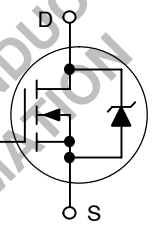
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6 AMPERES
30 VOLTS
$R_{DS(on)}$ = 35 mΩ
V_F = 0.42 Volts

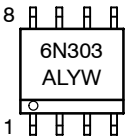
N−Channel





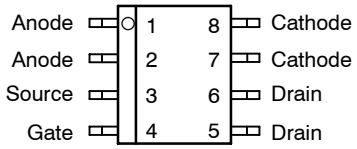
SO−8
CASE 751
STYLE 18

MARKING DIAGRAM



A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week

PIN ASSIGNMENT



Top View

ORDERING INFORMATION

Device	Package	Shipping†
MMDFS6N303R2	SO−8	2500/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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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 = 104°C	I_O	2.0	Amps
Peak Repetitive Forward Current (Note 3) (Rated V_R, Square Wave, 20 kHz) T_A = 108°C	I_{frm}	4.0	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	$R_{\theta JA}$	167	°C/W
Thermal Resistance — Junction−to−Ambient (Note 5) — MOSFET	$R_{\theta JA}$	97	
Thermal Resistance — Junction−to−Ambient (Note 2) — 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	

MOSFET ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted) (Note 6)

Characteristic	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 —	— —	— —	Vdc mV/°C
Zero Gate Drain Current (V_{DS} = 24 Vdc, V_{GS} = 0 Vdc) (V_{DS} = 24 Vdc, V_{GS} = 0 Vdc, T_J = 125°C)	I_{DSS}	— —	— —	1.0 20	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 —	— —	— —	Vdc
Static Drain−Source Resistance (V_{GS} = 10 Vdc, I_D = 5.0 Adc) (V_{GS} = 4.5 Vdc, I_D = 3.9 Adc)	$R_{DS(on)}$	— —	28 42	35 50	mΩ
Forward Transconductance (V_{DS} = 15 Vdc, I_D = 5.0 Adc)	g_{FS}	—	9.0	—	mhos
DYNAMIC CHARACTERISTICS					
Input Capacitance	C_{iss}	—	430	600	pF
Output Capacitance	C_{oss}	—	217	300	
Reverse Transfer Capacitance	C_{rss}	—	67.5	135	

(V_{DS} = 24 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)

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.
6. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

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MOSFET ELECTRICAL CHARACTERISTICS – continued (T_C = 25°C unless otherwise noted) (Note 7)

Characteristic		Symbol	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS (Note 8)						
Turn−On Delay Time	(V_{DD} = 15 Vdc, I_D = 1.0 Adc, V_{GS} = 10 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	—	8.2	16.5	ns
Rise Time		t_r	—	8.5	17	
Turn−Off Delay Time		$t_{d(off)}$	—	89.6	179	
Fall Time		t_f	—	61.1	122	
Gate Charge	(V_{DS} = 15 Vdc, I_D = 5.0 Adc, V_{GS} = 10 Vdc)	Q_T	—	15.7	31.4	nC
		Q_1	—	2.0	—	
		Q_2	—	4.6	—	
		Q_3	—	3.9	—	
DRAIN SOURCE DIODE CHARACTERISTICS						
Forward On−Voltage (Note 7)	(I_S = 1.7 Adc, V_{GS} = 0 Vdc)	V_{SD}	—	0.77	1.2	Vdc
Reverse Recovery Time	(V_{GS} = 0 V, I_S = 5.0 A, dIS/dt = 100 A/μs)	t_{rr}	—	54.5	—	ns
		t_a	—	14.8	—	
		t_b	—	39.7	—	
Reverse Recovery Stored Charge		Q_{RR}	—	0.048	—	μC

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

Maximum Instantaneous Forward Voltage (Note 7)	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 7)	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

7. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
8. Switching characteristics are independent of operating junction temperature.

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TYPICAL FET ELECTRICAL CHARACTERISTICS

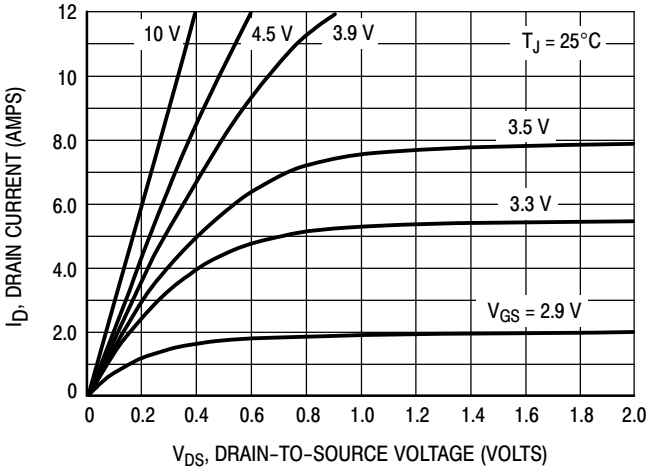


Figure 1. On−Region Characteristics

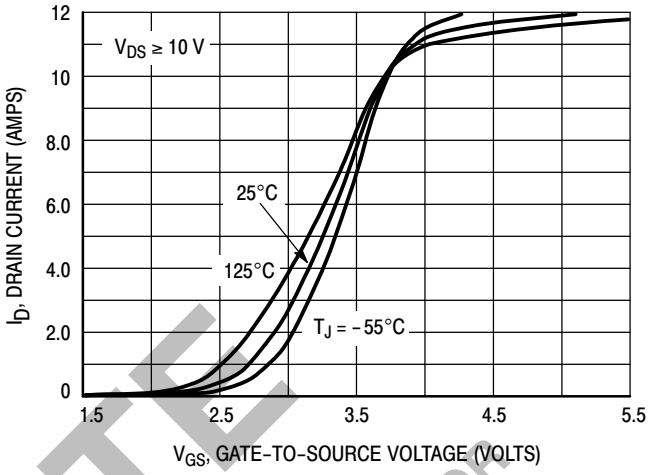


Figure 2. Transfer Characteristics

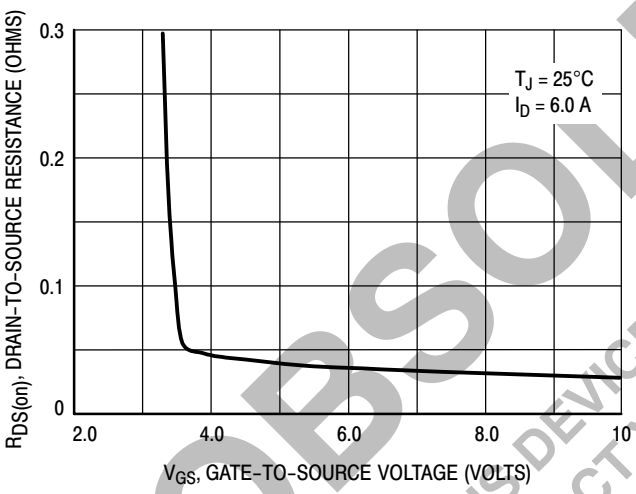


Figure 3. On−Resistance versus Gate−To−Source Voltage

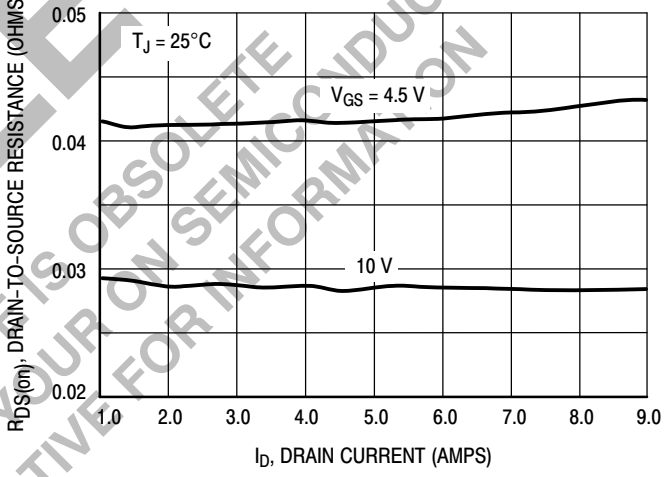


Figure 4. On−Resistance versus Drain Current and Gate Voltage

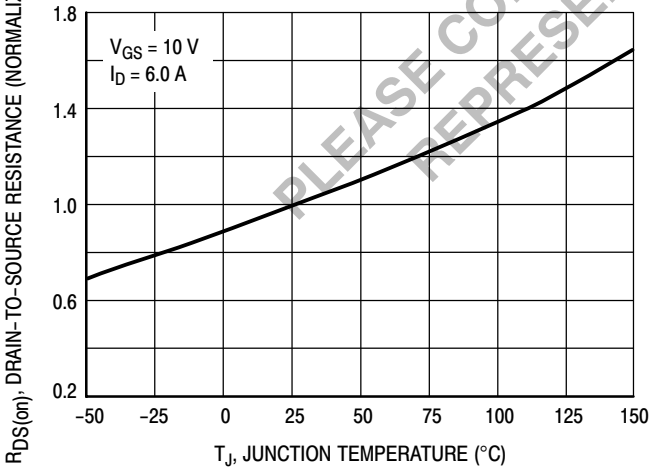


Figure 5. On−Resistance Variation with Temperature

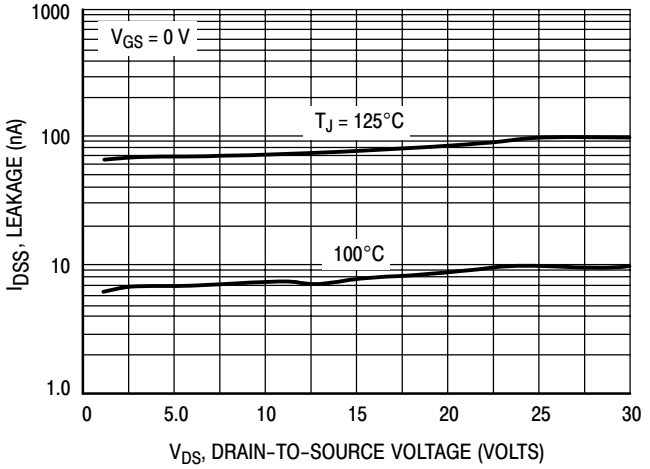


Figure 6. Drain−To−Source Leakage Current versus Voltage

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TYPICAL FET ELECTRICAL CHARACTERISTICS

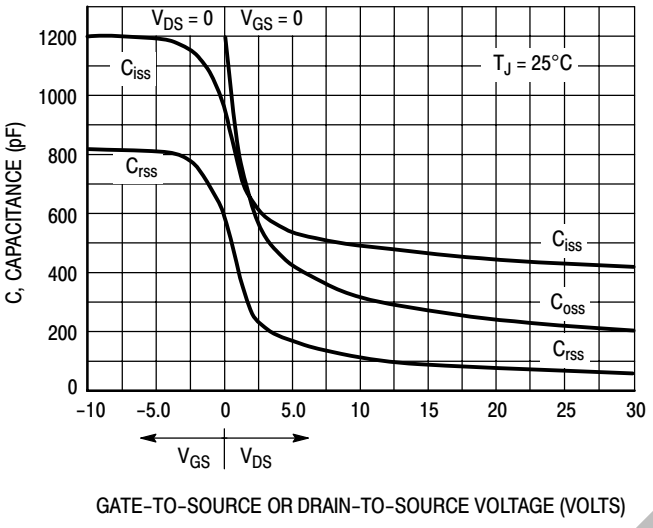


Figure 7. Capacitance Variation

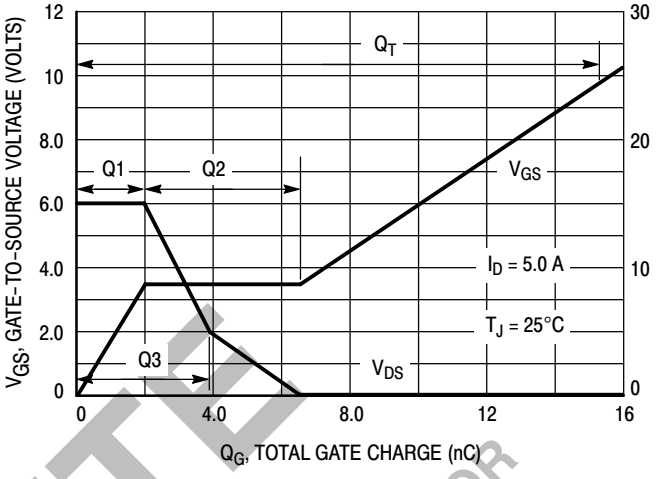


Figure 8. Gate−To−Source and Drain−To−Source Voltage versus Total Charge

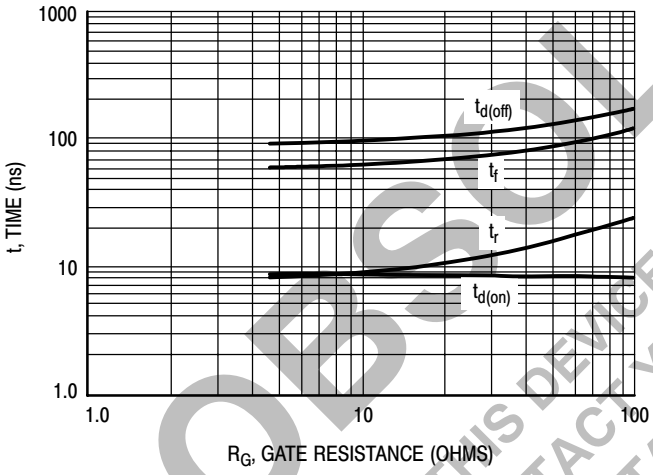


Figure 9. Resistive Switching Time Variation versus Gate Resistance

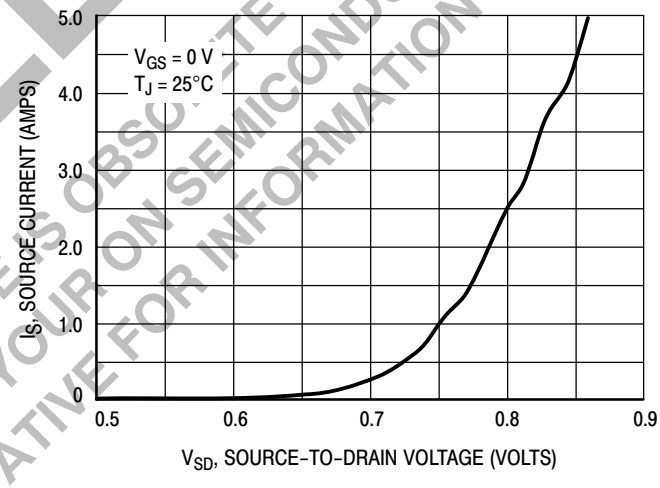


Figure 10. Diode Forward Voltage versus Current

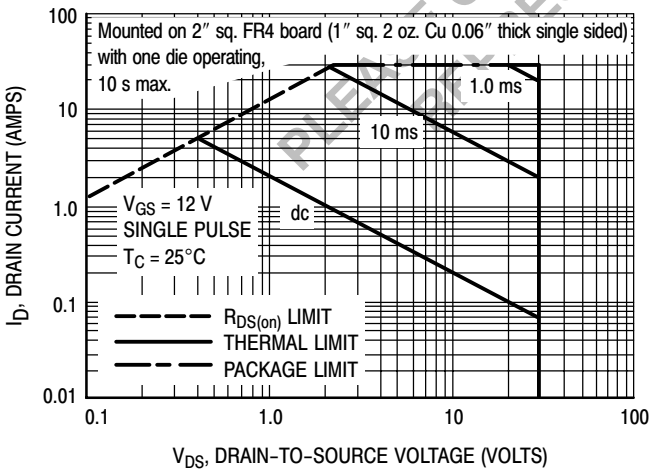


Figure 11. Maximum Rated Forward Biased Safe Operating Area

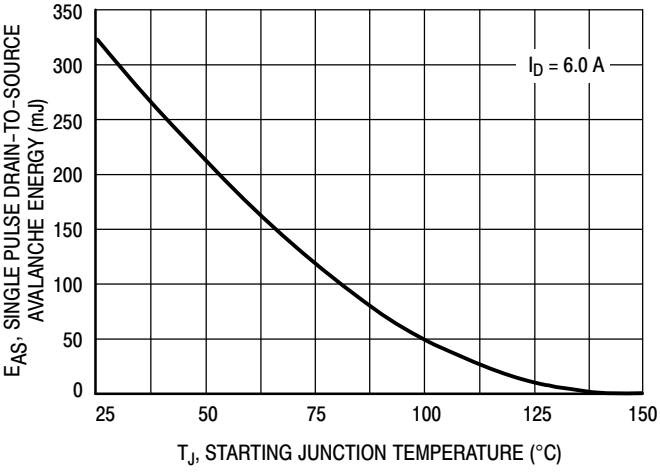


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

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TYPICAL FET ELECTRICAL CHARACTERISTICS

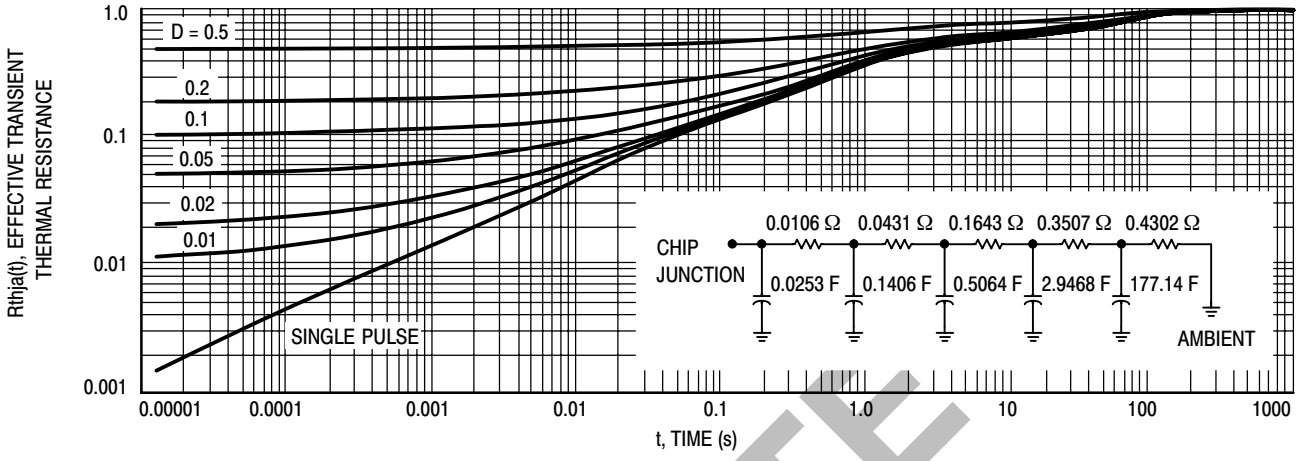


Figure 13. FET Thermal Response

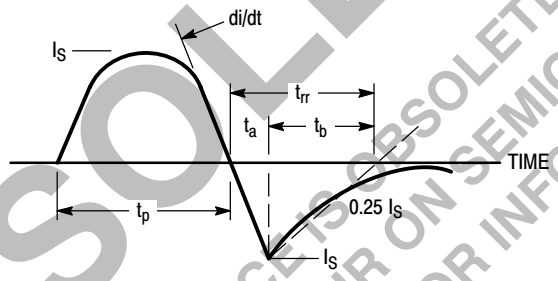


Figure 14. Diode Reverse Recovery Waveform

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TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

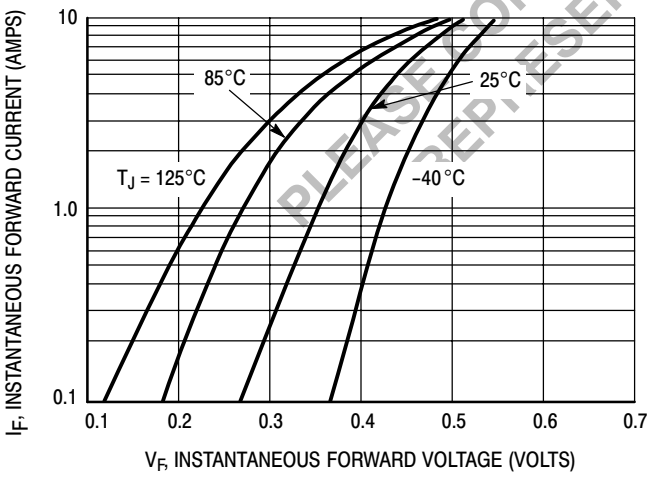


Figure 15. Typical Forward Voltage

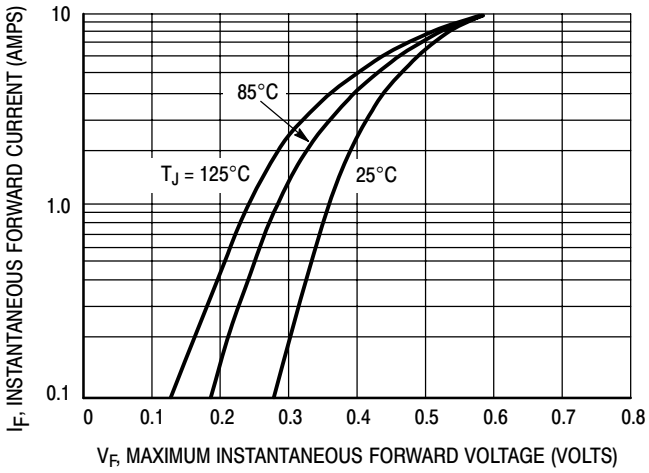


Figure 16. Maximum Forward Voltage

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

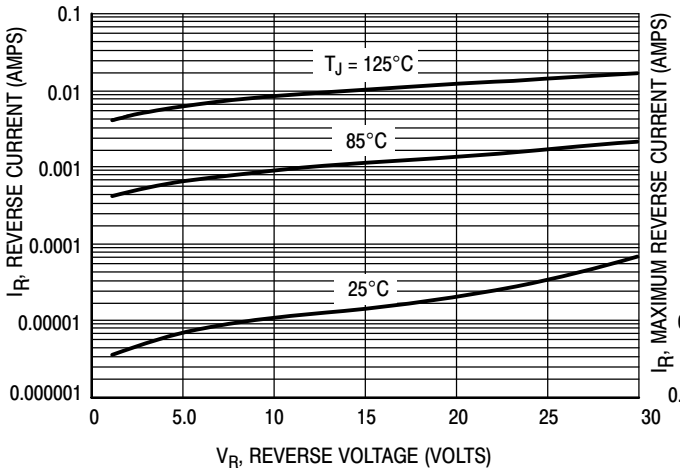


Figure 17. Typical Reverse Current

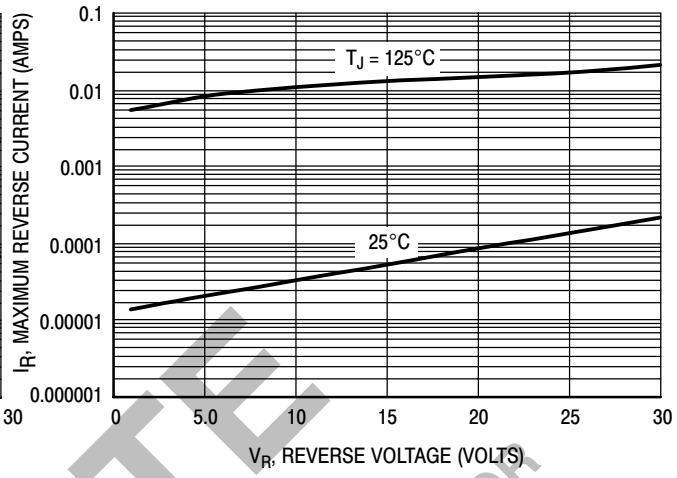


Figure 18. Maximum Reverse Current

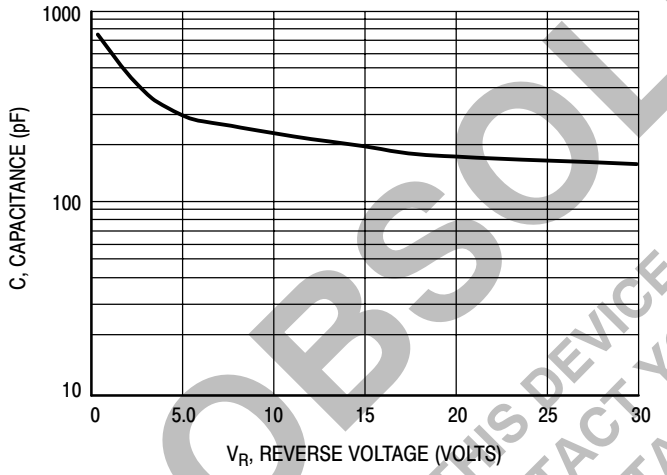


Figure 19. Typical Capacitance

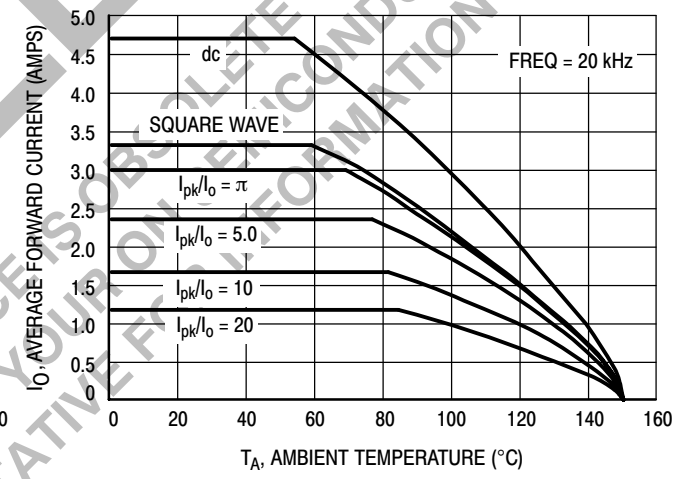


Figure 20. Current Derating

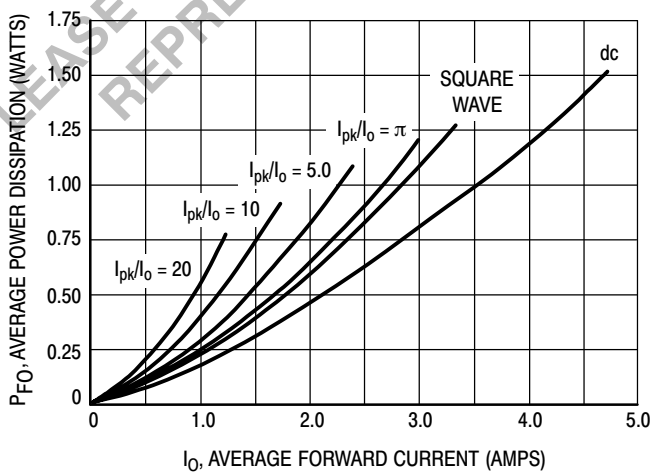


Figure 21. Forward Power Dissipation

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TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

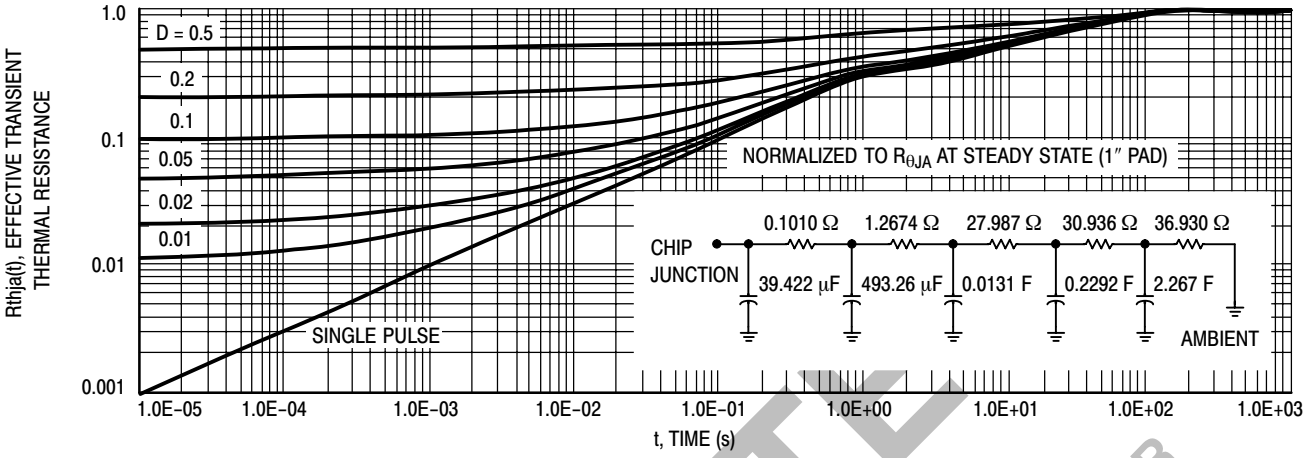
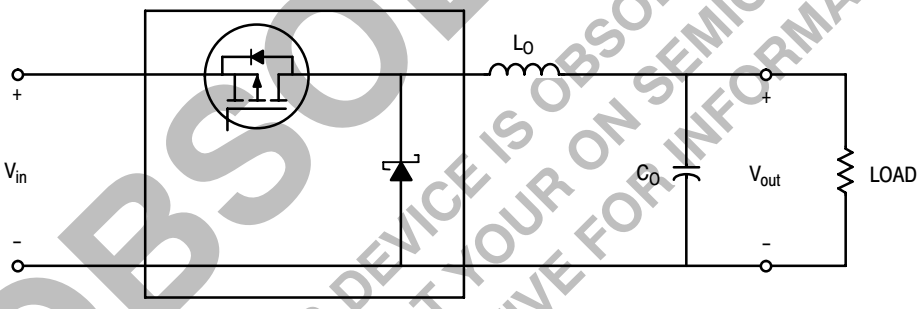


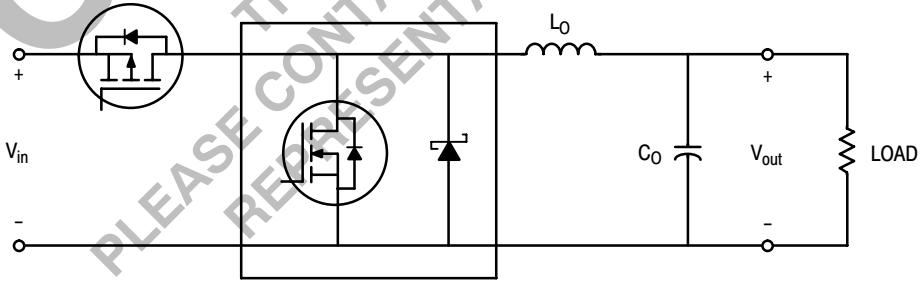
Figure 22. Schottky Thermal Response

TYPICAL APPLICATIONS

STEP DOWN SWITCHING REGULATORS



Buck Regulator

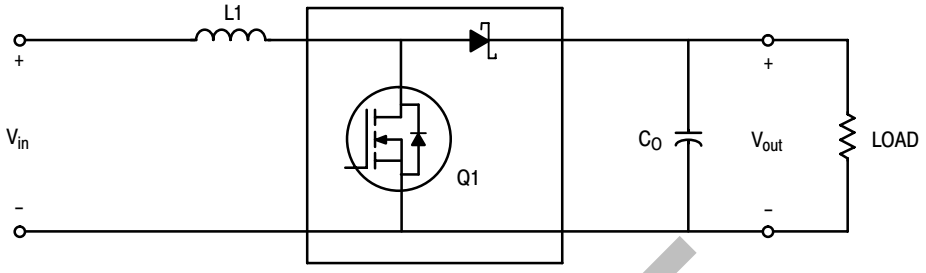


Synchronous Buck Regulator

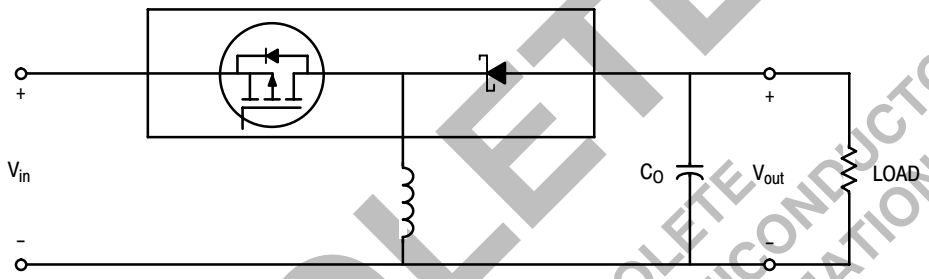
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TYPICAL APPLICATIONS

STEP UP SWITCHING REGULATORS



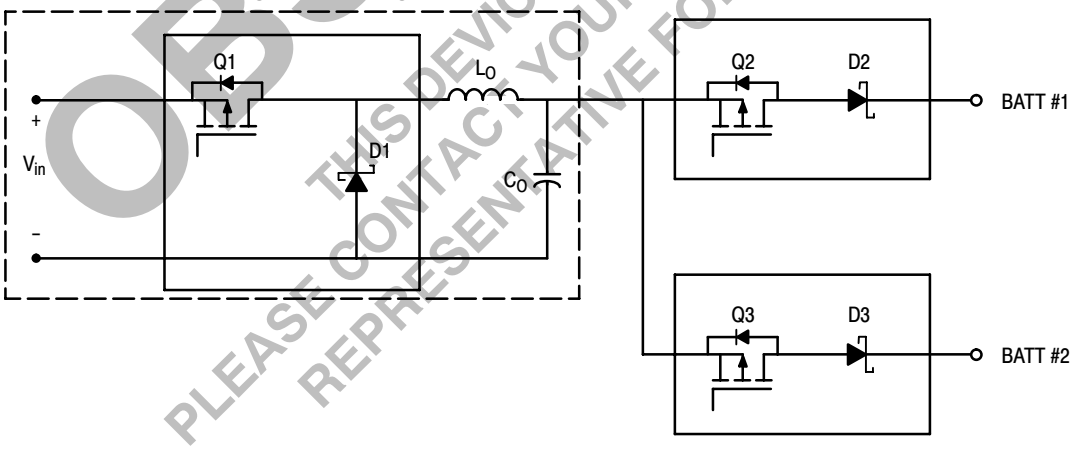
Boost Regulator



Buck−Boost Regulator

MULTIPLE BATTERY CHARGERS

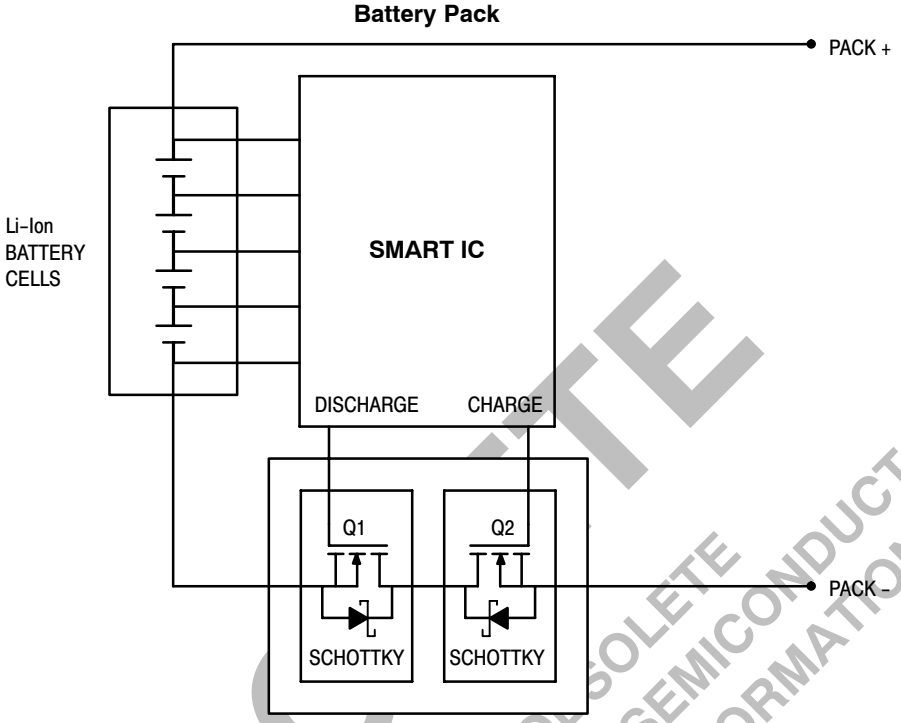
Buck Regulator/Charger



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TYPICAL APPLICATIONS

Li−Ion BATTERY PACK APPLICATIONS

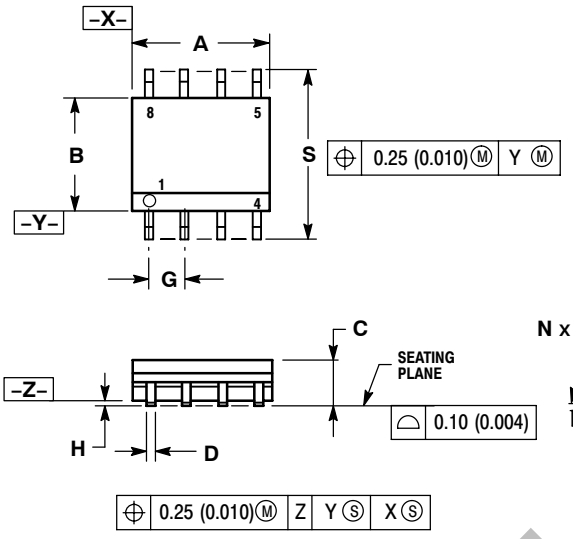


- Applicable in battery packs which require a high current level.
- During charge cycle Q2 is on and Q1 is off. Schottky can reduce power loss during fast charge.
- During discharge Q1 is on and Q2 is off. Again, Schottky can reduce power dissipation.
- Under normal operation, both transistors are on.

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PACKAGE DIMENSIONS

SO−8
CASE 751−07
ISSUE AB

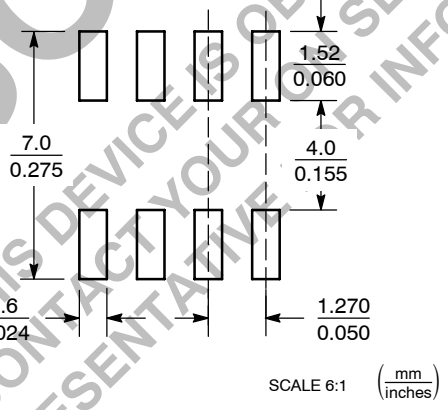


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

	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

SOLDERING FOOTPRINT*



SCALE 6:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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