NTMSD6N303R2

Power MOSFET

6 Amps, 30 Volts
N−Channel SO−8 FETKY™

The FETKY product family incorporates low $R_{DS(on)}$ MOSFETs packaged with an industry leading, low forward drop, low leakage Schottky Barrier rectifier 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.

Applications

- Buck Converter
- Buck−Boost
- Synchronous Rectification
- Low Voltage Motor Control
- Battery Packs
- Chargers
- Cell Phones

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 − 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}	325	mJ

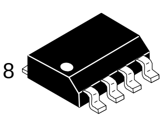
1. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.
2. Mounted on 2″ square FR4 board (1″ sq. 2 oz. Cu 0.06″ thick single sided), 10 sec. max.

ON Semiconductor®

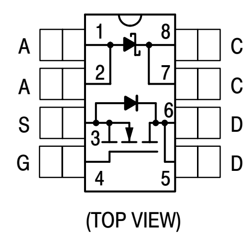
http://onsemi.com

MOSFET
6.0 AMPERES
30 VOLTS
24 mΩ @ V_{GS} = 10 V (Typ)

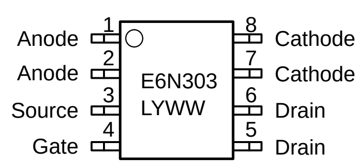
SCHOTTKY DIODE
6.0 AMPERES
30 VOLTS
420 mV @ I_F = 3.0 A



SO−8
CASE 751
STYLE 18



MARKING DIAGRAM
& PIN ASSIGNMENTS



(Top View)

E6N303 = Device Code
L = Assembly Location
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping†
NTMSD6N303R2	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.

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

Rating	Symbol	Value	Unit
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 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	

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

Characteristics	Symbol	Value		Unit
Maximum Instantaneous Forward Voltage (Note 6)	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 (Note 6)	I_R	**T_J = 25°C**	**T_J = 125°C**	
V_R = 30 V		250 −	− 25	μA mA
Maximum Voltage Rate of Change V_R = 30 V	dV/dt	10,000		V/μs

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%

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain−to−Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 250 μA)		$V_{(BR)DSS}$	30	−	−	Vdc
Temperature Coefficient (Positive)			−	30	−	mV/°C
Zero Gate Voltage Drain Current (V_{DS} = 24 Vdc, V_{GS} = 0 Vdc, T_J = 25°C)		I_{DSS}	−	−	1.0	μAdc
(V_{DS} = 24 Vdc, V_{GS} = 0 Vdc, T_J = 125°C)			−	−	20	
Gate−Body Leakage Current (V_{GS} = ±20 Vdc, V_{DS} = 0 Vdc)		I_{GSS}	−	−	100	nAdc
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = 250 μAdc)		$V_{GS(th)}$	1.0	1.8	2.5	Vdc
Temperature Coefficient (Negative)			−	4.6	−	mV/°C
Static Drain−to−Source On−State Resistance (V_{GS} = 10 Vdc, I_D = 6 Adc)		$R_{DS(on)}$	−	0.024	0.032	Ω
(V_{GS} = 4.5 Vdc, I_D = 3.9 Adc)			−	0.030	0.040	
Forward Transconductance (V_{DS} = 15 Vdc, I_D = 5.0 Adc)		g_{FS}	−	10	−	Mhos
DYNAMIC CHARACTERISTICS						
Input Capacitance	(V_{DS} = 24 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{iss}	−	680	950	pF
Output Capacitance		C_{oss}	−	210	300	
Reverse Transfer Capacitance		C_{rss}	−	70	135	
SWITCHING CHARACTERISTICS (Notes 7 & 8)						
Turn−On Delay Time	(V_{DD} = 15 Vdc, I_D = 1 A, V_{GS} = 10 V, R_G = 6 Ω)	$t_{d(on)}$	−	9	18	ns
Rise Time		t_r	−	22	40	
Turn−Off Delay Time		$t_{d(off)}$	−	45	80	
Fall Time		t_f	−	45	80	
Turn−On Delay Time	(V_{DD} = 15 Vdc, I_D = 1 A, V_{GS} = 4.5 V, R_G = 6 Ω)	$t_{d(on)}$	−	13	30	ns
Rise Time		t_r	−	27	50	
Turn−Off Delay Time		$t_{d(off)}$	−	22	40	
Fall Time		t_f	−	34	70	
Gate Charge	(V_{DS} = 15 Vdc, V_{GS} = 10 Vdc, I_D = 5 A)	Q_T	−	19	30	nC
		Q_1	−	2.4	−	
		Q_2	−	5.0	−	
		Q_3	−	4.3	−	
BODY−DRAIN DIODE RATINGS (Note 7)						
Diode Forward On−Voltage	(I_S = 1.7 Adc, V_{GS} = 0 V)	V_{SD}	−	0.75	1.0	Vdc
	(I_S = 1.7 Adc, V_{GS} = 0 V, T_J = 150°C)		−	0.62	−	
Reverse Recovery Time	(I_S = 5 A, V_{GS} = 0 V, dI_S/dt = 100 A/μs)	t_{rr}	−	26	−	ns
		t_a	−	11	−	
		t_b	−	15	−	
Reverse Recovery Stored Charge (I_S = 5 A, dI_S/dt = 100 A/μs, V_{GS} = 0 V)		Q_{RR}	−	0.015	−	μC

7. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
8. Switching characteristics are independent of operating junction temperature.

TYPICAL MOSFET ELECTRICAL CHARACTERISTICS

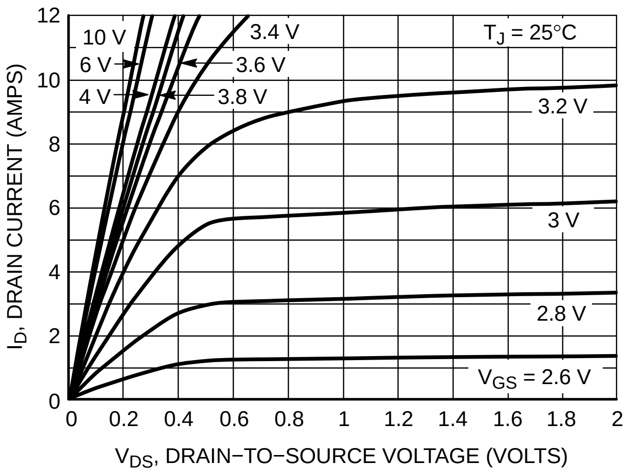


Figure 1. On−Region Characteristics

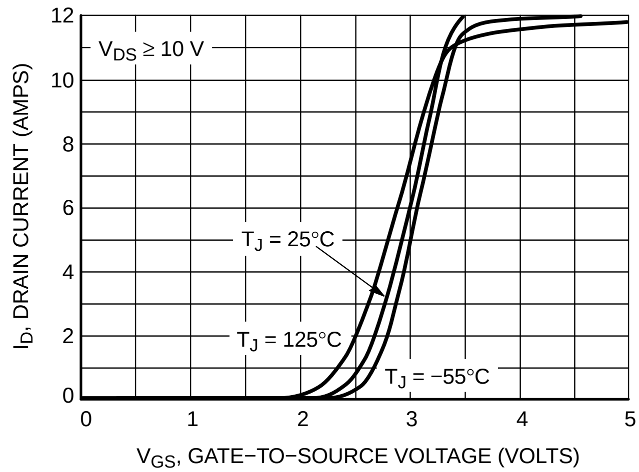


Figure 2. Transfer Characteristics

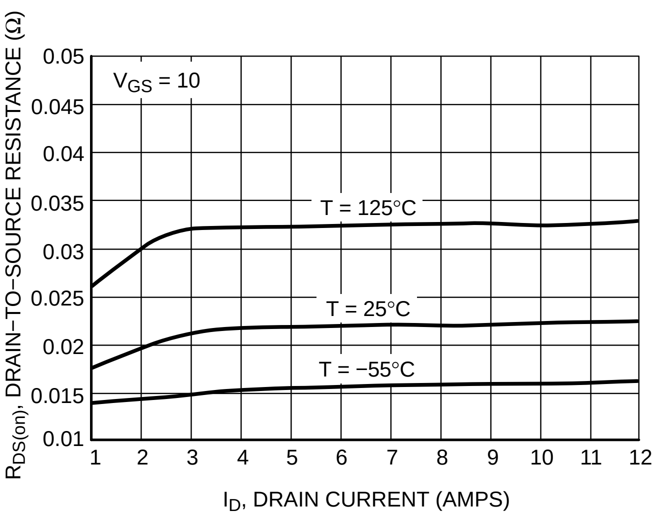


Figure 3. On−Resistance versus Drain Current and Temperature

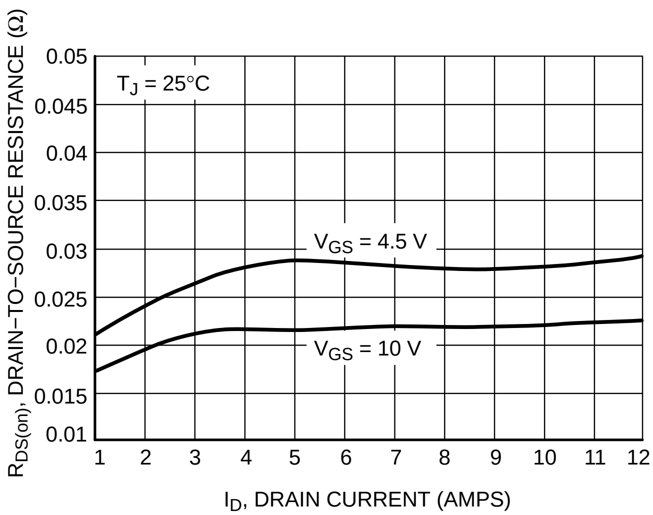


Figure 4. On−Resistance versus Drain Current and Gate Voltage

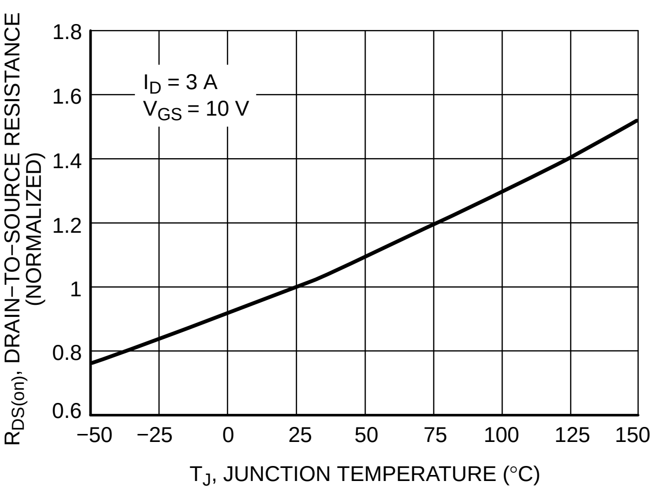


Figure 5. On−Resistance Variation with Temperature

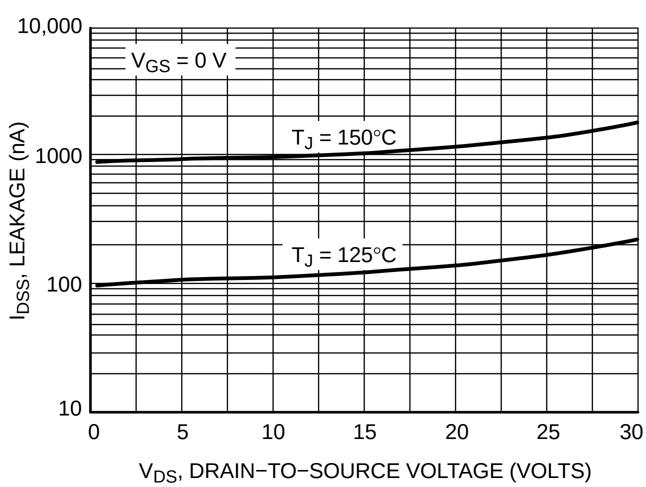


Figure 6. Drain−to−Source Leakage Current versus Voltage

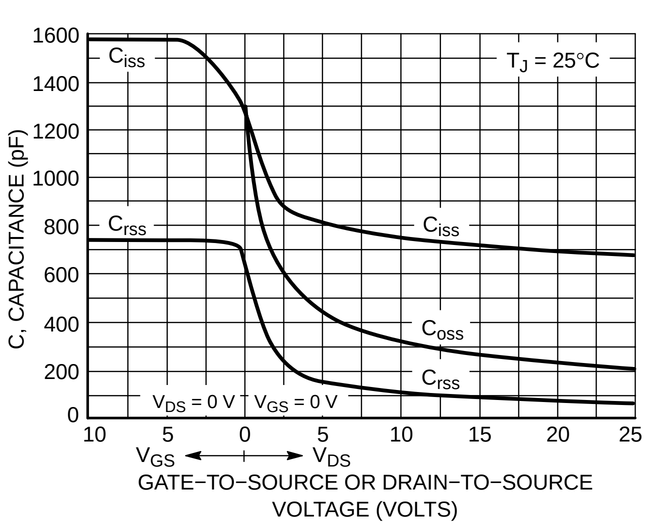


Figure 7. Capacitance Variation

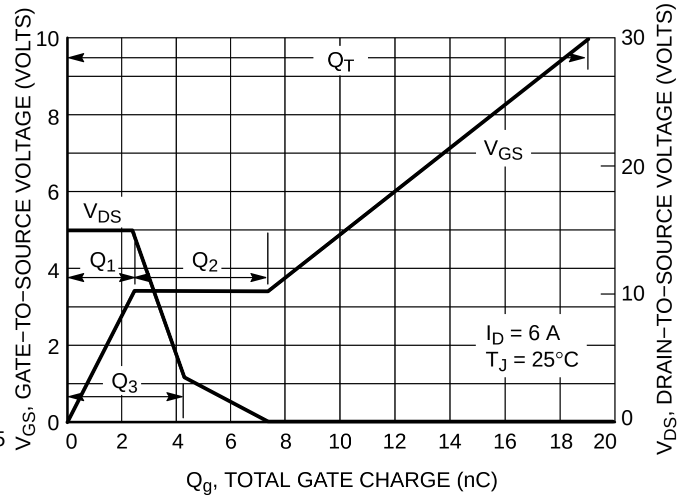


Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

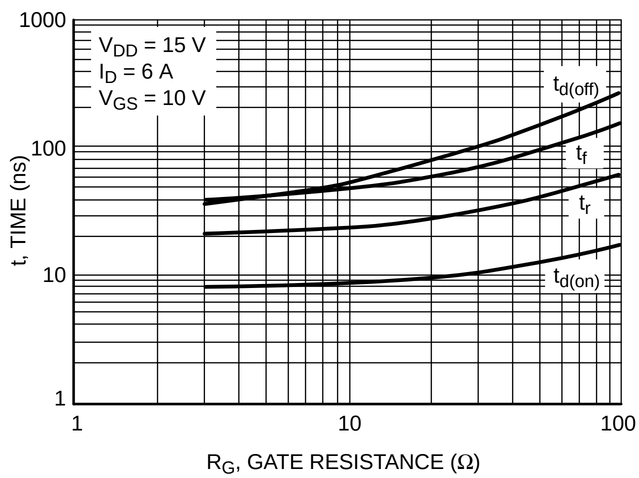


Figure 9. Resistive Switching Time Variation versus Gate Resistance

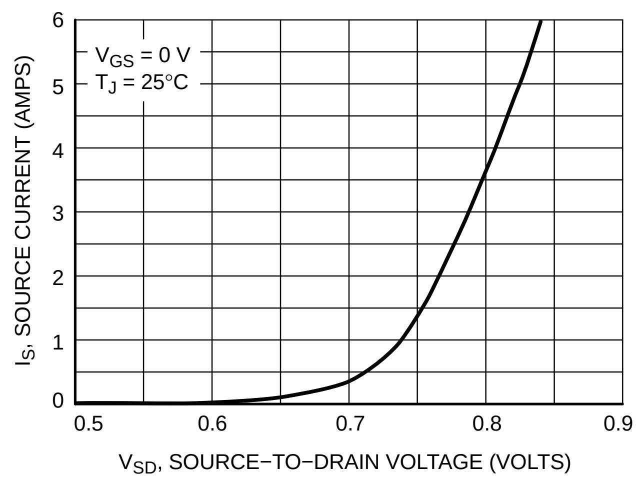


Figure 10. Diode Forward Voltage versus Current

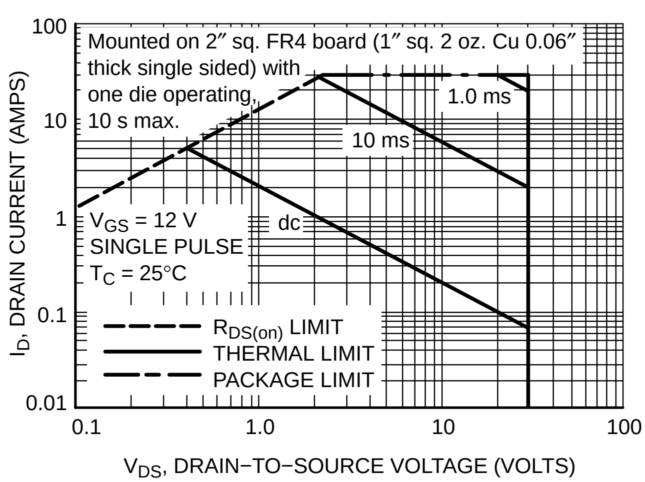


Figure 11. Maximum Rated Forward Biased Safe Operating Area

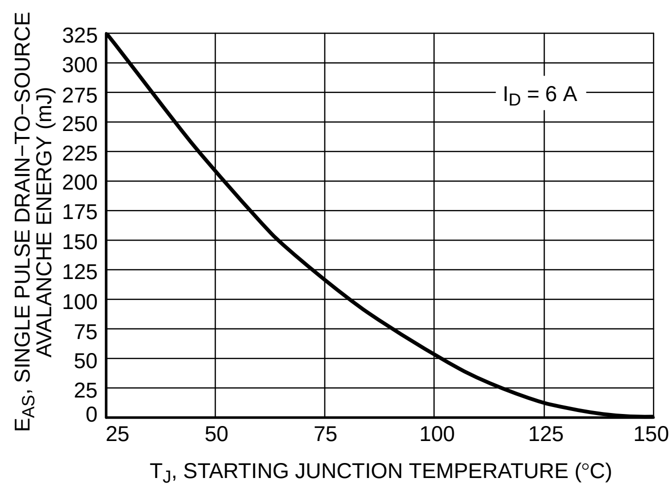


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

TYPICAL FET ELECTRICAL CHARACTERISTICS

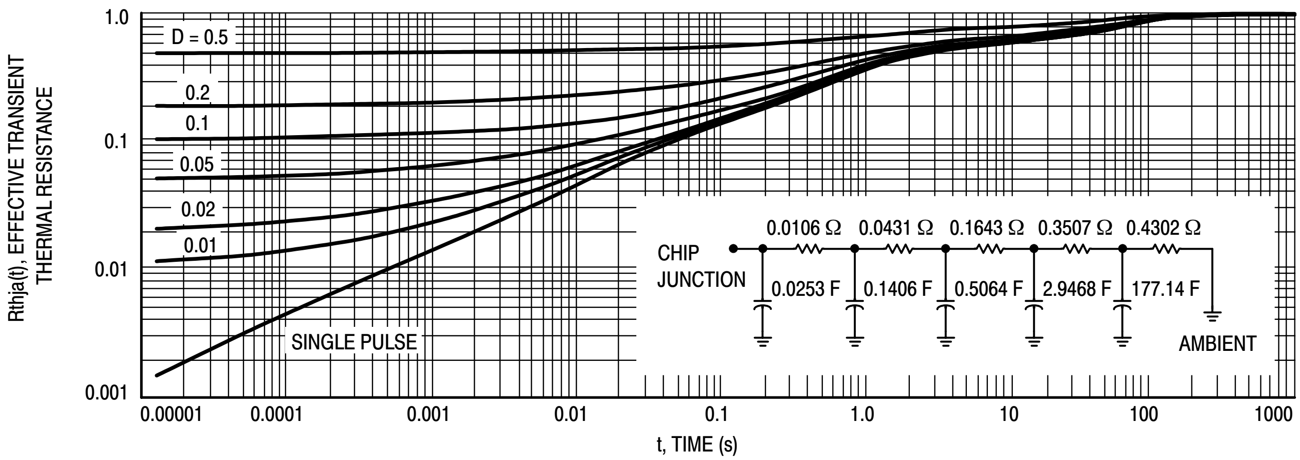


Figure 13. FET Thermal Response

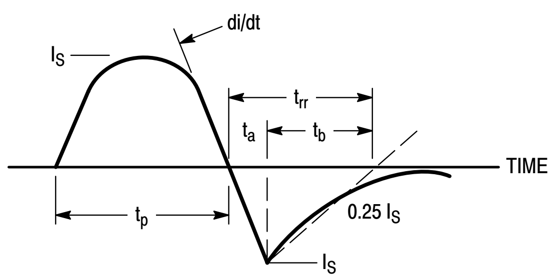


Figure 14. Diode Reverse Recovery Waveform

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

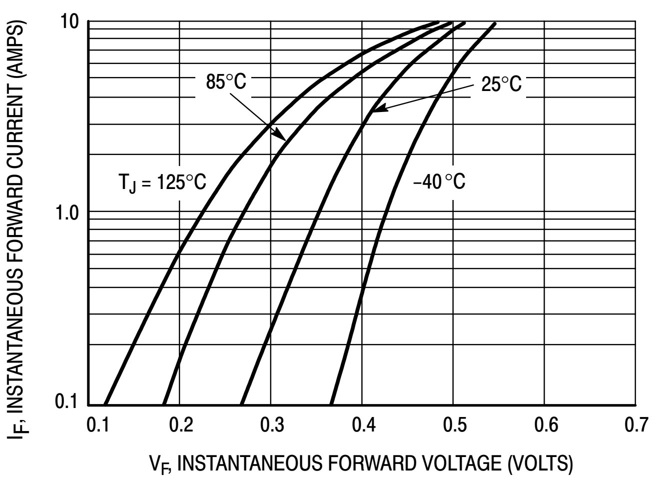


Figure 15. Typical Forward Voltage

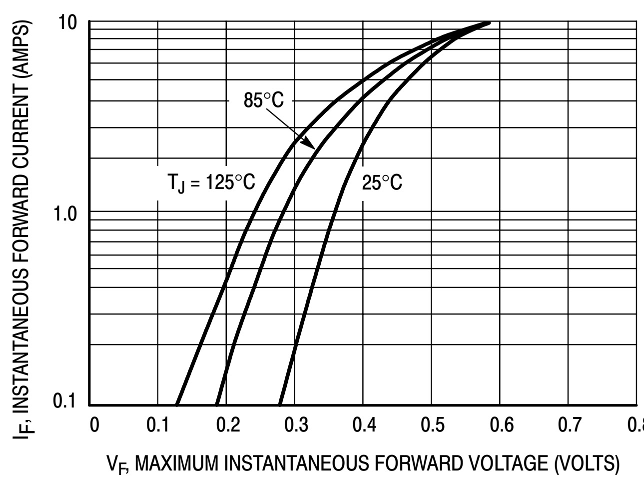


Figure 16. Maximum Forward Voltage

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

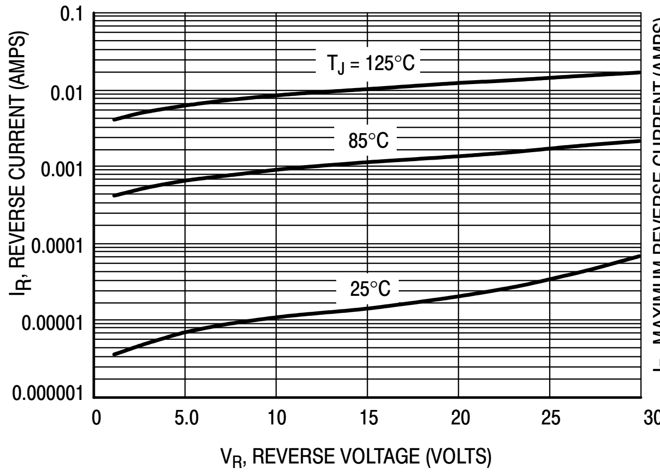


Figure 17. Typical Reverse Current

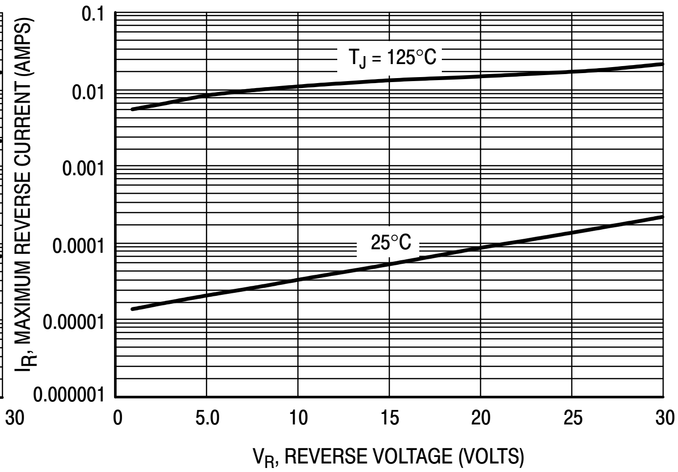


Figure 18. Maximum Reverse Current

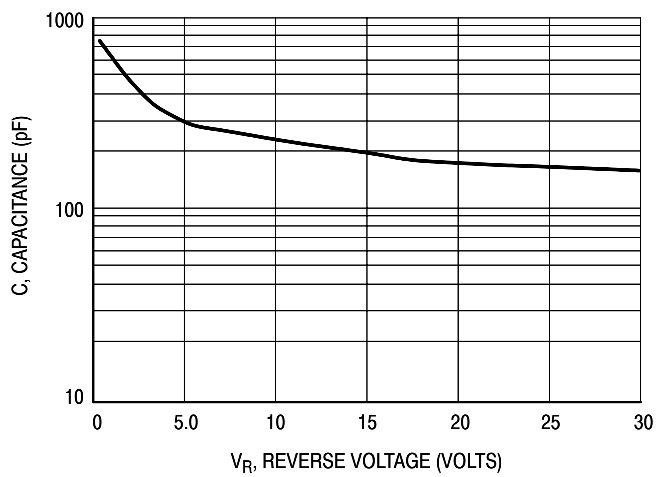


Figure 19. Typical Capacitance

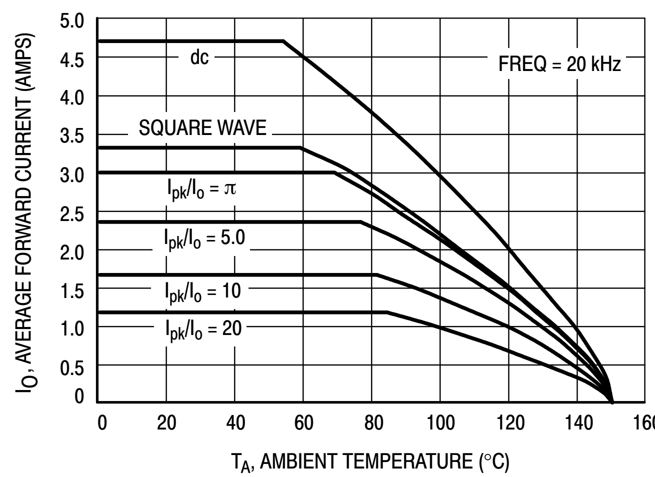


Figure 20. Current Derating

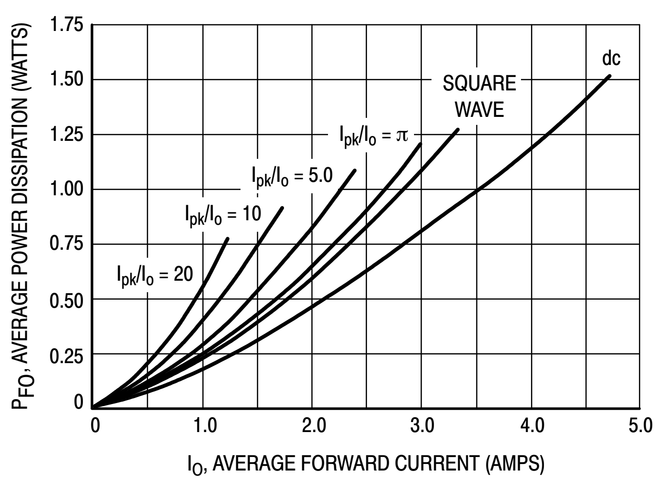


Figure 21. Forward Power Dissipation

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

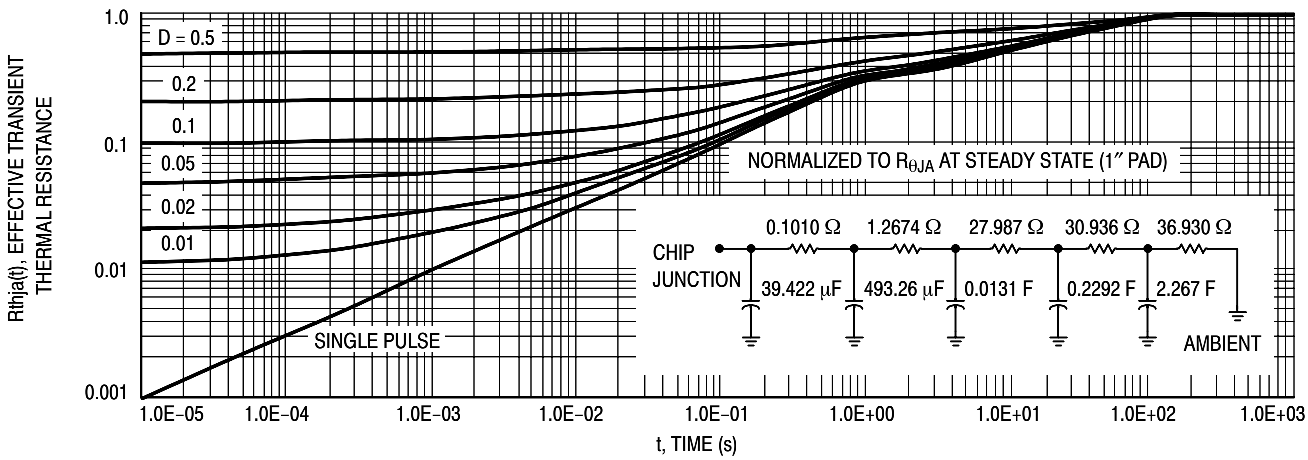
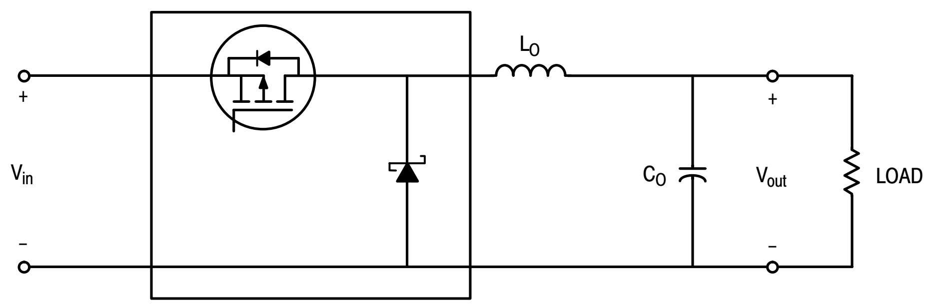


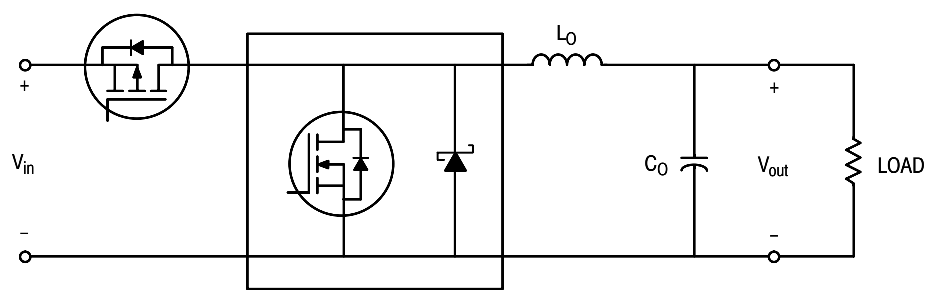
Figure 22. Schottky Thermal Response

TYPICAL APPLICATIONS

STEP DOWN SWITCHING REGULATORS



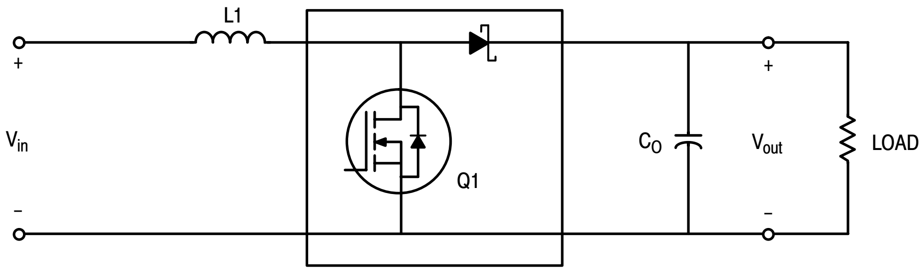
Buck Regulator



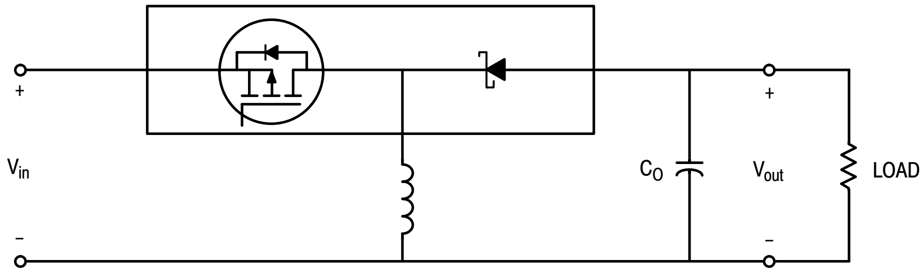
Synchronous Buck Regulator

TYPICAL APPLICATIONS

STEP UP SWITCHING REGULATORS



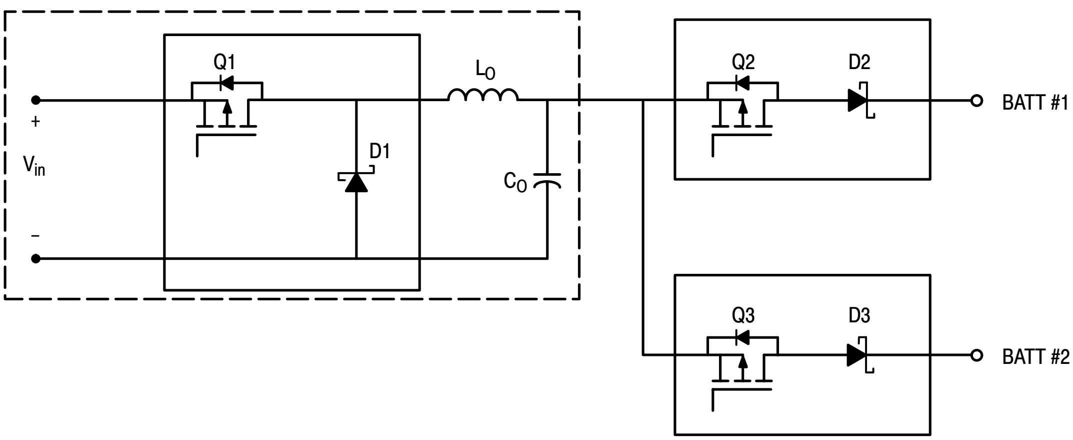
Boost Regulator



Buck−Boost Regulator

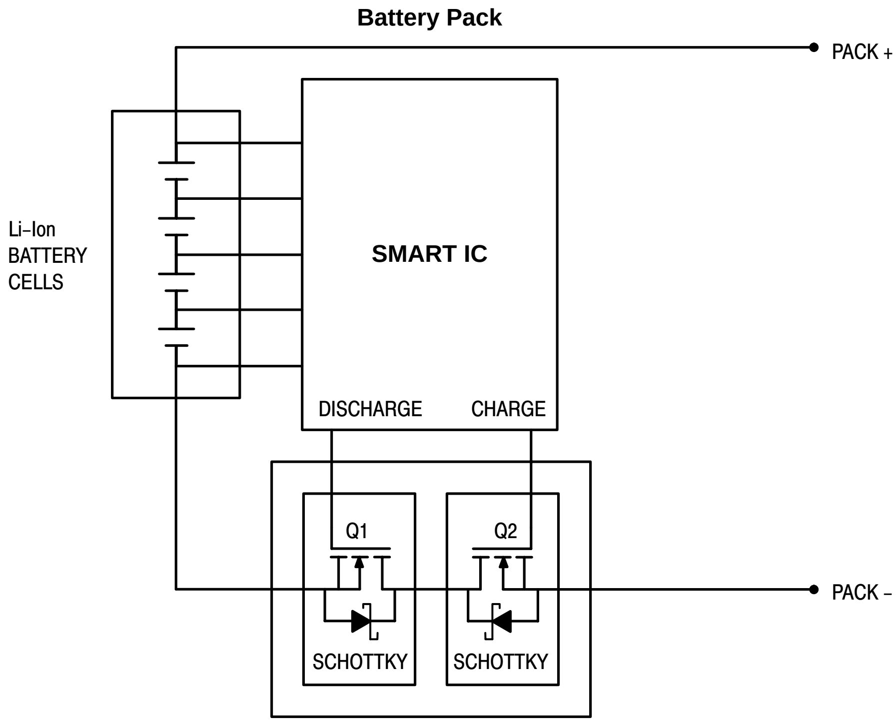
MULTIPLE BATTERY CHARGERS

Buck Regulator/Charger



TYPICAL APPLICATIONS

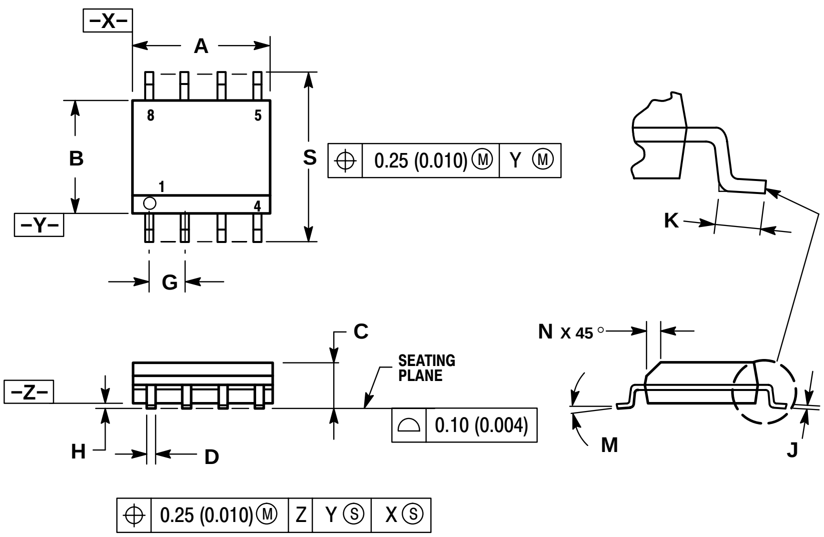
Li−Ion BATTERY PACK APPLICATIONS



- 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.

PACKAGE DIMENSIONS

SO−8
CASE 751−07
ISSUE AA

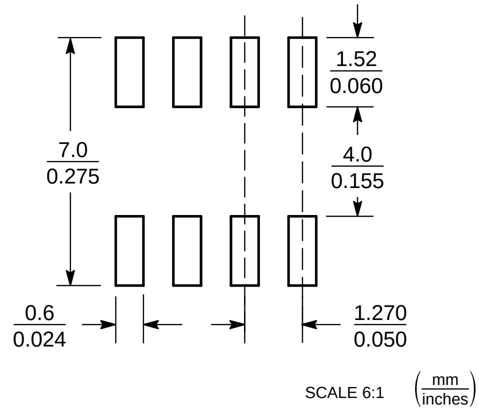


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005)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



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

FETKY is a trademark of International Rectifier Corporation.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2−9−1 Kamimeguro, Meguro−ku, Tokyo, Japan 153−0051
Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

Order Literature: http://www.onsemi.com/litorder

For additional information, please contact your local Sales Representative.