

NTMSD3P303R2

FETKY™

P-Channel Enhancement-Mode Power MOSFET and Schottky Diode Dual SO-8 Package

Features

- High Efficiency Components in a Single SO-8 Package
- High Density Power MOSFET with Low $R_{DS(on)}$, Schottky Diode with Low V_F
- Independent Pin-Outs for MOSFET and Schottky Die Allowing for Flexibility in Application Use
- Less Component Placement for Board Space Savings
- SO-8 Surface Mount Package, Mounting Information for SO-8 Package Provided
- Pb-Free Package is Available

Applications

- DC-DC Converters
- Low Voltage Motor Control
- Power Management in Portable and Battery-Powered Products, i.e.: Computers, Printers, PCMCIA Cards, Cellular and Cordless Telephones

MOSFET MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	-30	V
Gate-to-Source Voltage – Continuous	V_{GS}	± 20	V
Thermal Resistance – Junction-to-Ambient (Note 1) Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $T_A = 70^\circ\text{C}$ Pulsed Drain Current (Note 4)	$R_{\theta JA}$ P_D I_D I_D I_{DM}	171 0.73 -2.34 -1.87 -8.0	$^\circ\text{C/W}$ W A A A
Thermal Resistance – Junction-to-Ambient (Note 2) Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $T_A = 70^\circ\text{C}$ Pulsed Drain Current (Note 4)	$R_{\theta JA}$ P_D I_D I_D I_{DM}	100 1.25 -3.05 -2.44 -12	$^\circ\text{C/W}$ W A A A
Thermal Resistance – Junction-to-Ambient (Note 3) Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $T_A = 70^\circ\text{C}$ Pulsed Drain Current (Note 4)	$R_{\theta JA}$ P_D I_D I_D I_{DM}	62.5 2.0 -3.86 -3.10 -15	$^\circ\text{C/W}$ W A A A
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$ ($V_{DD} = -30\text{ Vdc}$, $V_{GS} = -4.5\text{ Vdc}$, Peak $I_L = -7.5\text{ Apk}$, $L = 5\text{ mH}$, $R_G = 25\ \Omega$)	E_{AS}	140	mJ
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	T_L	260	$^\circ\text{C}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Minimum FR-4 or G-10 PCB, Steady State.
2. Mounted onto a 2" square FR-4 Board
(1 in sq, 2 oz Cu 0.06" thick single sided), Steady State.
3. Mounted onto a 2" square FR-4 Board
(1 in sq, 2 oz Cu 0.06" thick single sided), $t \leq 10$ seconds.
4. Pulse Test: Pulse Width = 300 μs , Duty Cycle = 2%.

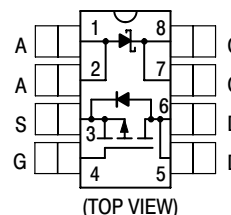


ON Semiconductor®

<http://onsemi.com>

MOSFET
-3.05 AMPERES
-30 VOLTS
0.085 Ω @ $V_{GS} = -10\text{ V}$

SCHOTTKY DIODE
3.0 AMPERES
30 VOLTS
420 mV @ $I_F = 3.0\text{ A}$

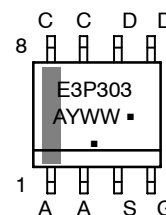


(TOP VIEW)

MARKING DIAGRAM & PIN ASSIGNMENT



SO-8
CASE 751
STYLE 18



E3P303 = Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NTMSD3P303R2	SO-8	2500/Tape & Reel
NTMSD3P303R2G	SO-8 (Pb-Free)	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.

NTMSD3P303R2

SCHOTTKY MAXIMUM RATINGS ($T_J = 25^{\circ}\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage DC Blocking Voltage	V_{RRM} V_R	30	V
Thermal Resistance – Junction-to-Ambient (Note 5)	$R_{\theta JA}$	197	$^{\circ}\text{C/W}$
Thermal Resistance – Junction-to-Ambient (Note 6)	$R_{\theta JA}$	97	$^{\circ}\text{C/W}$
Thermal Resistance – Junction-to-Ambient (Note 7)	$R_{\theta JA}$	62.5	$^{\circ}\text{C/W}$
Average Forward Current (Note 7) (Rated V_R , $T_A = 100^{\circ}\text{C}$)	I_O	3.0	A
Peak Repetitive Forward Current (Note 7) (Rated V_R , Square Wave, 20 kHz, $T_A = 105^{\circ}\text{C}$)	I_{FRM}	6.0	A
Non-Repetitive Peak Surge Current (Note 7) (Surge Applied at Rated Load Conditions, Half-Wave, Single Phase, 60 Hz)	I_{FSM}	30	A

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

5. Minimum FR-4 or G-10 PCB, Steady State.

6. Mounted onto a 2" square FR-4 Board (1 in sq, 2 oz Cu 0.06" thick single sided), Steady State.

7. Mounted onto a 2" square FR-4 Board (1 in sq, 2 oz Cu 0.06" thick single sided), $t \leq 10$ seconds.

ELECTRICAL CHARACTERISTICS ($T_J = 25^{\circ}\text{C}$ unless otherwise noted) (Note 8)

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage ($V_{GS} = 0$ Vdc, $I_D = -250$ μAdc) Temperature Coefficient (Positive)	$V_{(BR)DSS}$	-30 –	– –30	– –	Vdc $\text{mV}/^{\circ}\text{C}$
Zero Gate Voltage Drain Current ($V_{DS} = -30$ Vdc, $V_{GS} = 0$ Vdc, $T_J = 25^{\circ}\text{C}$) ($V_{DS} = -30$ Vdc, $V_{GS} = 0$ Vdc, $T_J = 125^{\circ}\text{C}$)	I_{DSS}	– –	– –	-1.0 -25	μAdc
Gate-Body Leakage Current ($V_{GS} = -20$ Vdc, $V_{DS} = 0$ Vdc)	I_{GSS}	–	–	-100	nAdc
Gate-Body Leakage Current ($V_{GS} = +20$ Vdc, $V_{DS} = 0$ Vdc)	I_{GSS}	–	–	100	nAdc

ON CHARACTERISTICS

Gate Threshold Voltage ($V_{DS} = V_{GS}$, $I_D = -250$ μAdc) Temperature Coefficient (Negative)	$V_{GS(th)}$	-1.0 –	-1.7 3.6	-2.5 –	Vdc
Static Drain-to-Source On-State Resistance ($V_{GS} = -10$ Vdc, $I_D = -3.05$ Adc) ($V_{GS} = -4.5$ Vdc, $I_D = -1.5$ Adc)	$R_{DS(on)}$	– –	0.063 0.090	0.085 0.125	Ω
Forward Transconductance ($V_{DS} = -15$ Vdc, $I_D = -3.05$ Adc)	g_{FS}	–	5.0	–	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	(V _{DS} = -24 Vdc, V _{GS} = 0 Vdc, f = 1.0 MHz)	C_{iss}	–	520	750	pF
Output Capacitance		C_{oss}	–	170	325	
Reverse Transfer Capacitance		C_{rss}	–	70	135	

8. Handling precautions to protect against electrostatic discharge are mandatory.

NTMSD3P303R2

MOSFET ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted) (Note 9)

Characteristic	Symbol	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS (Notes 10 & 11)					
Turn-On Delay Time	$t_{d(on)}$	–	12	22	ns
Rise Time	t_r	–	16	30	
Turn-Off Delay Time	$t_{d(off)}$	–	45	80	
Fall Time	t_f	–	45	80	
Turn-On Delay Time	$t_{d(on)}$	–	16	–	ns
Rise Time	t_r	–	42	–	
Turn-Off Delay Time	$t_{d(off)}$	–	32	–	
Fall Time	t_f	–	35	–	
Total Gate Charge	Q_{tot}	–	16	25	nC
Gate–Source Charge	Q_{gs}	–	2.0	–	
Gate–Drain Charge	Q_{gd}	–	4.5	–	

BODY–DRAIN DIODE RATINGS (Note 10)

Diode Forward On–Voltage	$(I_S = -3.05 \text{ Adc}, V_{GS} = 0 \text{ Vdc})$ $(I_S = -3.05 \text{ Adc}, V_{GS} = 0 \text{ Vdc}, T_J = 125^\circ\text{C})$	V_{SD}	– –	–0.96 –0.78	–1.25 –	Vdc
Reverse Recovery Time	$(I_S = -3.05 \text{ Adc}, V_{GS} = 0 \text{ Vdc}, dI_S/dt = 100 \text{ A}/\mu\text{s})$	t_{rr}	–	34	–	ns
		t_a	–	18	–	
		t_b	–	16	–	
Reverse Recovery Stored Charge		Q_{RR}	–	0.03	–	μC

9. Handling precautions to protect against electrostatic discharge is mandatory.

10. Indicates Pulse Test: Pulse Width = 300 μs max, Duty Cycle = 2%.

11. Switching characteristics are independent of operating junction temperature.

SCHOTTKY RECTIFIER ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted) (Note 12)

Maximum Instantaneous Forward Voltage	V_F	$T_J = 25^\circ\text{C}$	$T_J = 125^\circ\text{C}$	Volts
$I_F = 100 \text{ mAdc}$ $I_F = 3.0 \text{ Adc}$ $I_F = 6.0 \text{ Adc}$		0.28 0.42 0.50	0.13 0.33 0.45	Volts
Maximum Instantaneous Reverse Current	I_R	$T_J = 25^\circ\text{C}$	$T_J = 125^\circ\text{C}$	μA mA
$V_R = 30 \text{ Vdc}$		250	25	
Maximum Voltage Rate of Change	dV/dt	10,000		V/ μs

12. Indicates Pulse Test: Pulse Width = 300 μs max, Duty Cycle = 2%.

TYPICAL MOSFET ELECTRICAL CHARACTERISTICS

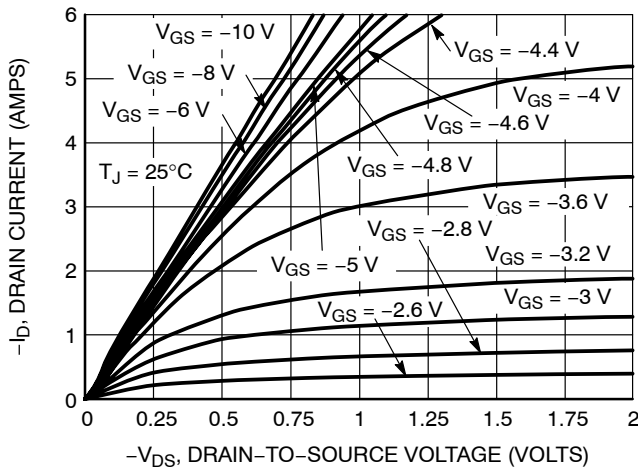


Figure 1. On-Region Characteristics

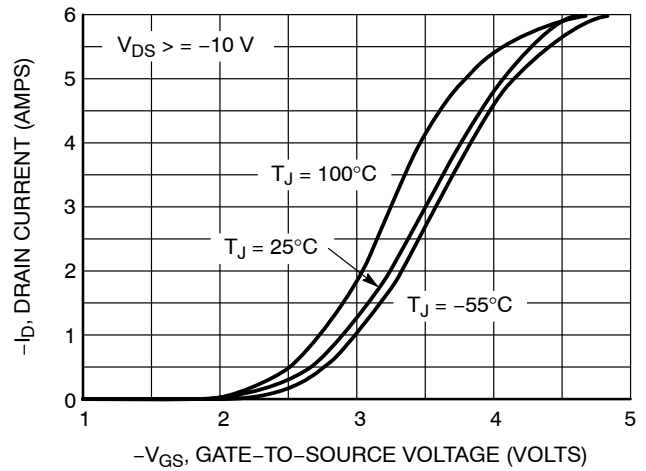


Figure 2. Transfer Characteristics

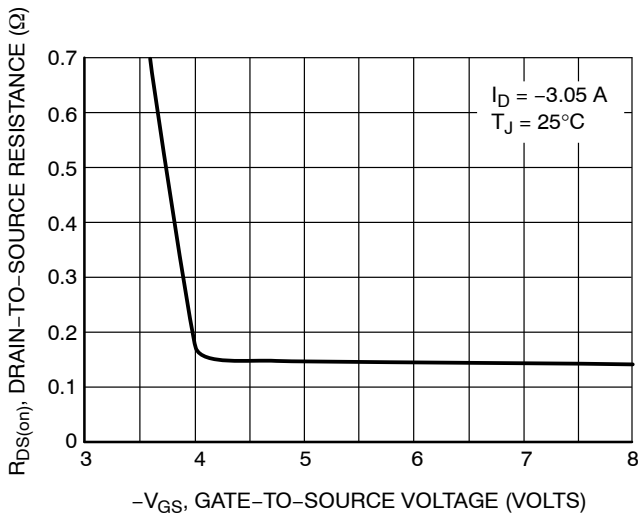


Figure 3. On-Resistance vs. Gate-to-Source Voltage

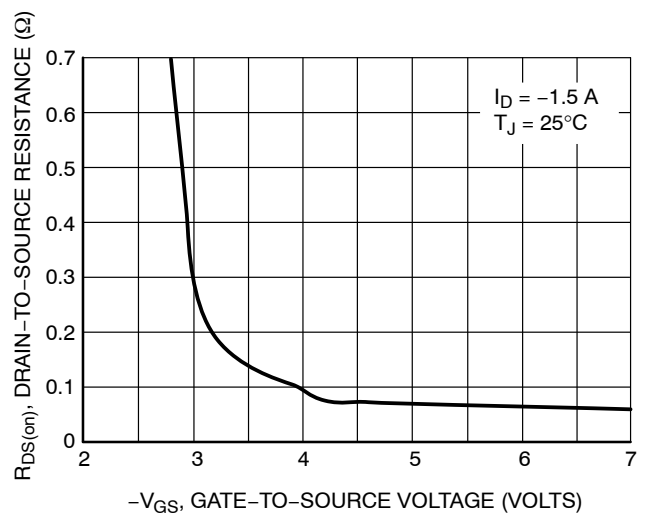


Figure 4. On-Resistance vs. Gate-to-Source Voltage

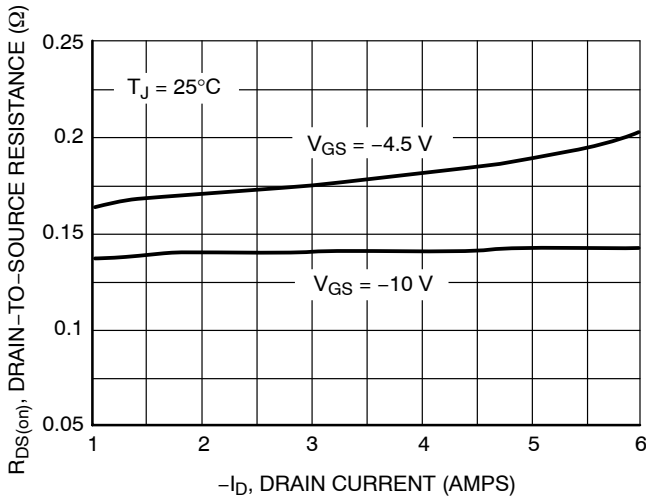


Figure 5. On-Resistance vs. Drain Current and Gate Voltage

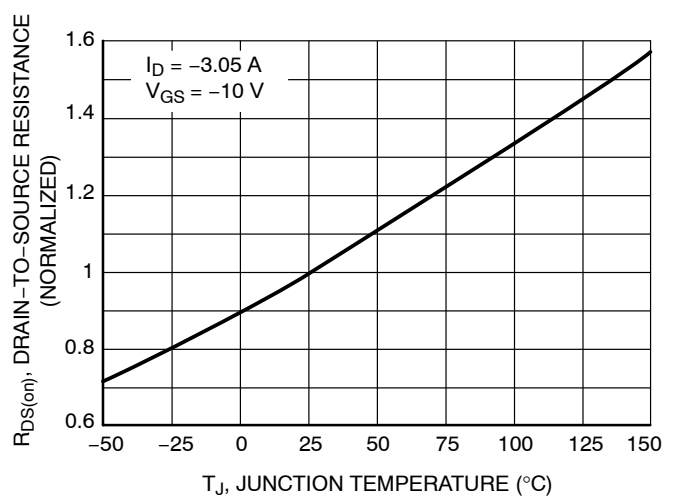


Figure 6. On Resistance Variation with Temperature

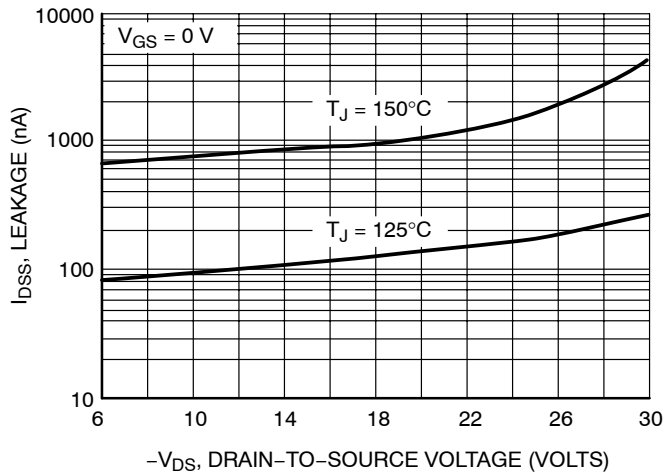


Figure 7. Drain-to-Source Leakage Current vs. Voltage

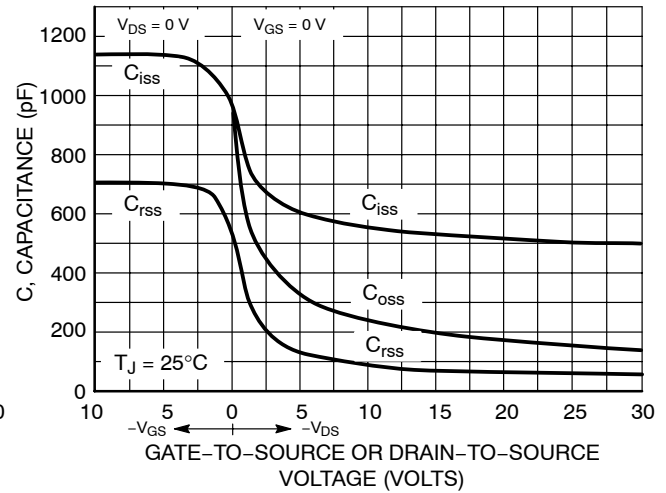


Figure 8. Capacitance Variation

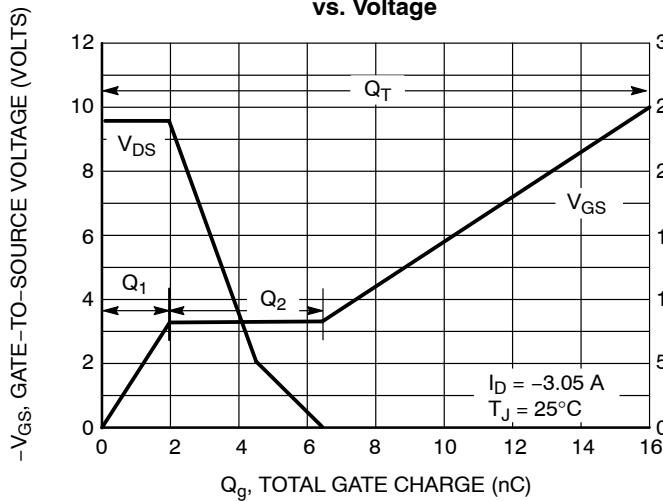


Figure 9. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

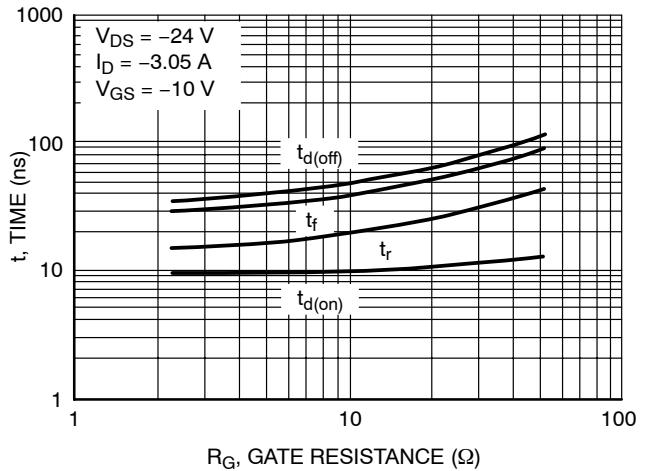


Figure 10. Resistive Switching Time Variation vs. Gate Resistance

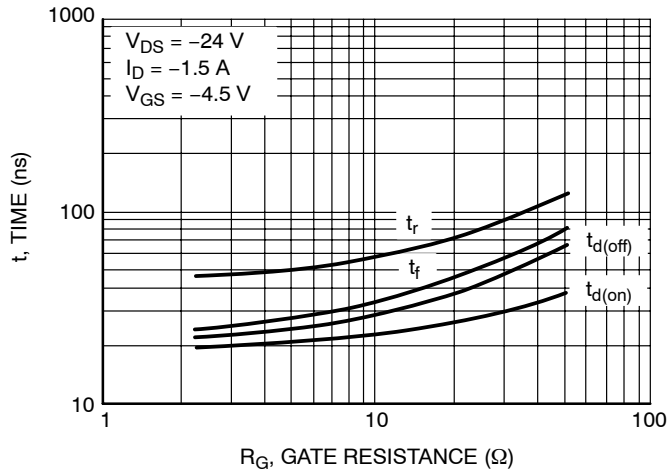


Figure 11. Resistive Switching Time Variation vs. Gate Resistance

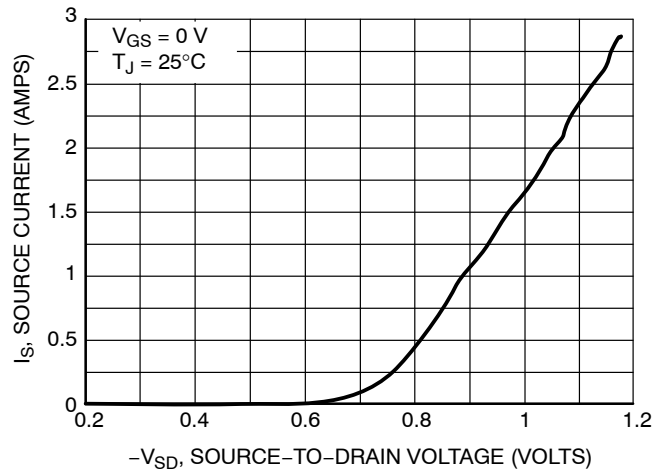


Figure 12. Diode Forward Voltage vs. Current

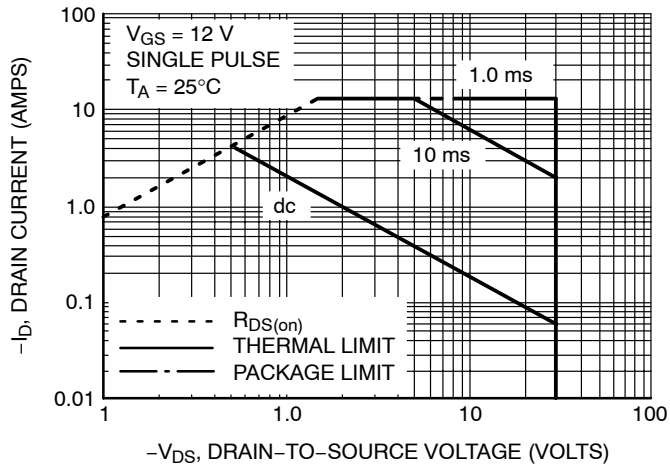


Figure 13. Maximum Rated Forward Biased Safe Operating Area

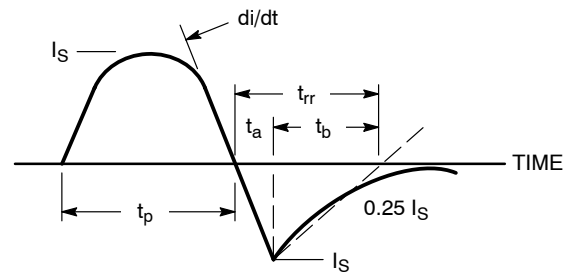


Figure 14. Diode Reverse Recovery Waveform

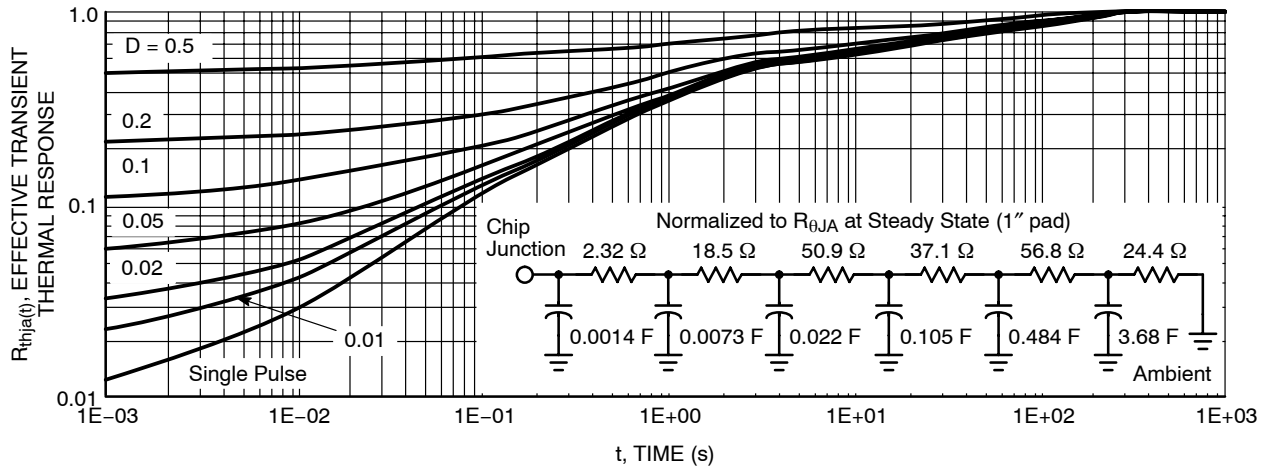


Figure 15. FET Thermal Response

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

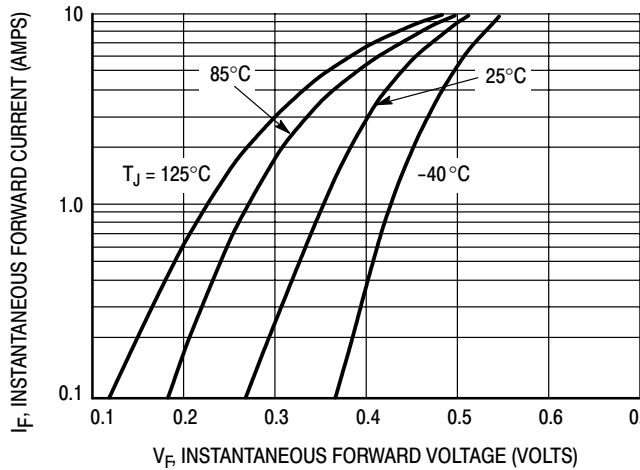


Figure 16. Typical Forward Voltage

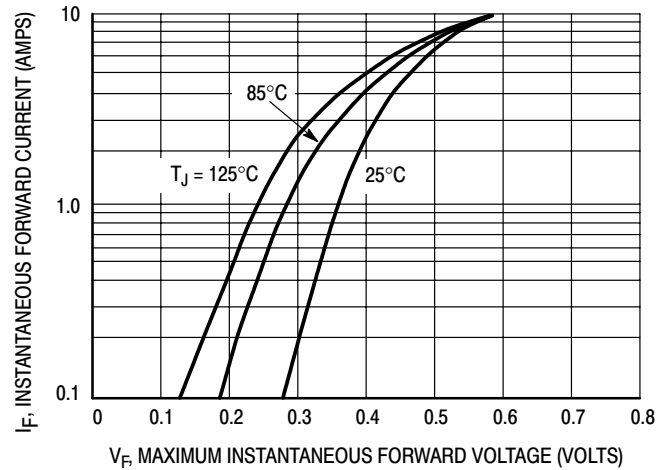


Figure 17. Maximum Forward Voltage

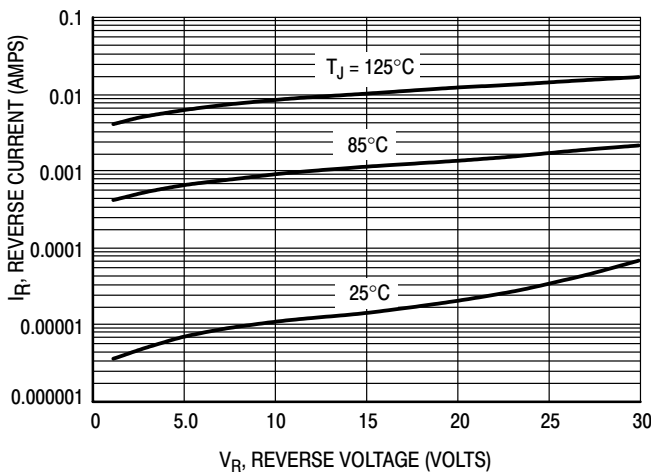


Figure 18. Typical Reverse Current

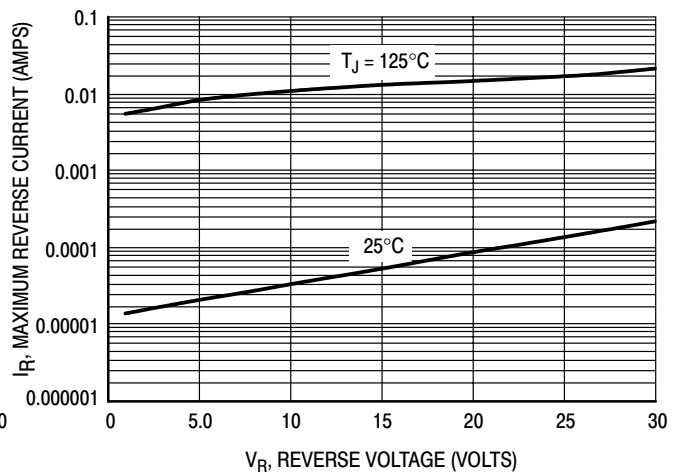


Figure 19. Maximum Reverse Current

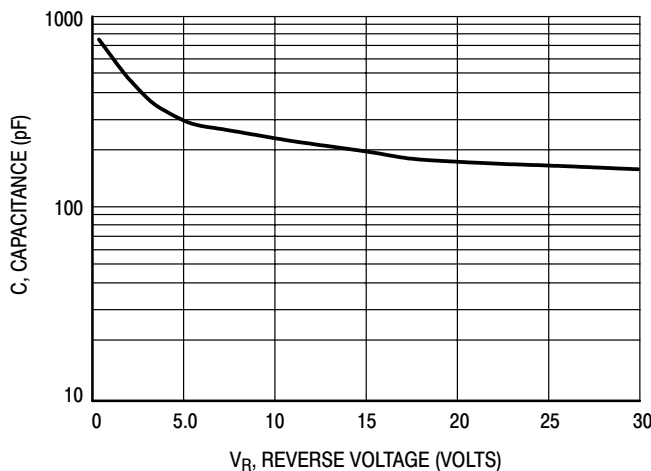


Figure 20. Typical Capacitance

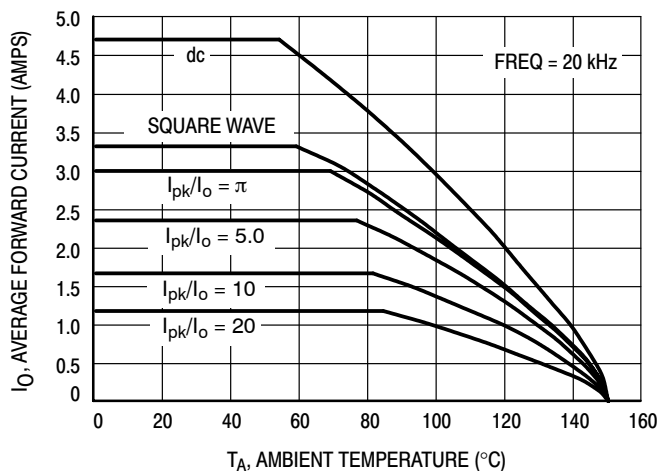


Figure 21. Current Derating

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

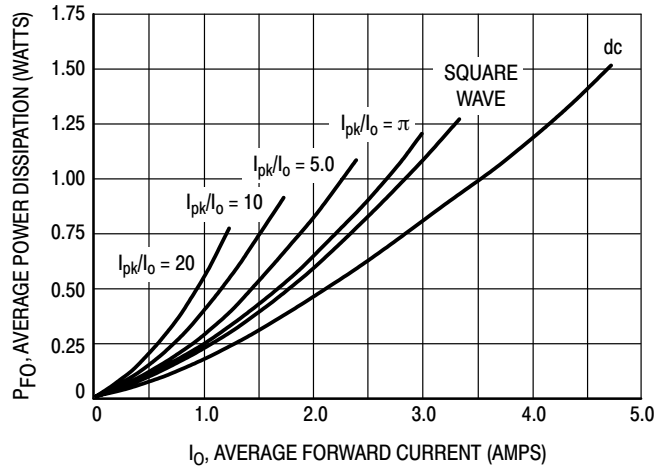


Figure 22. Forward Power Dissipation

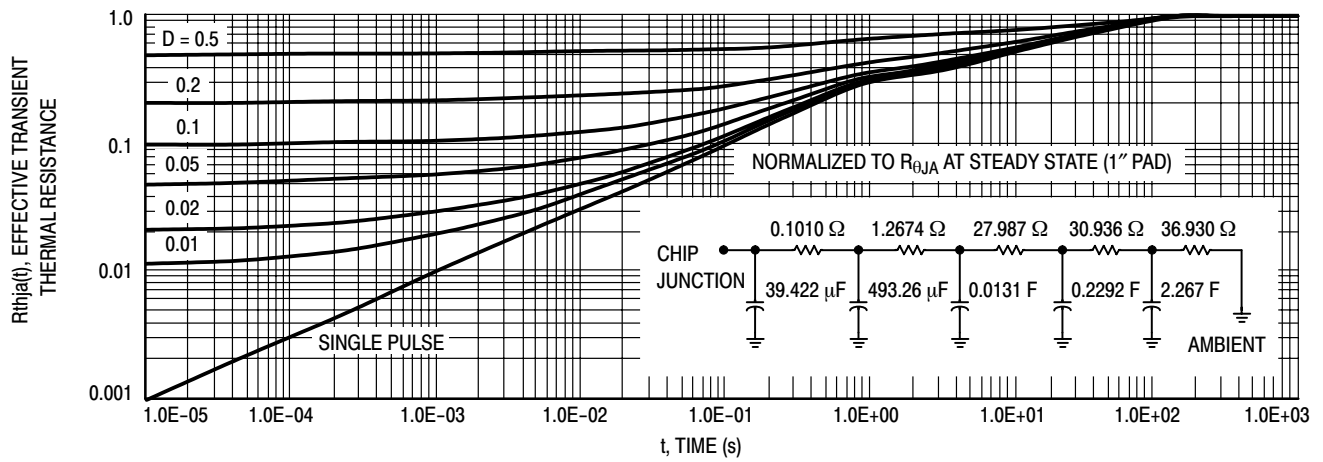
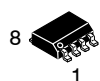


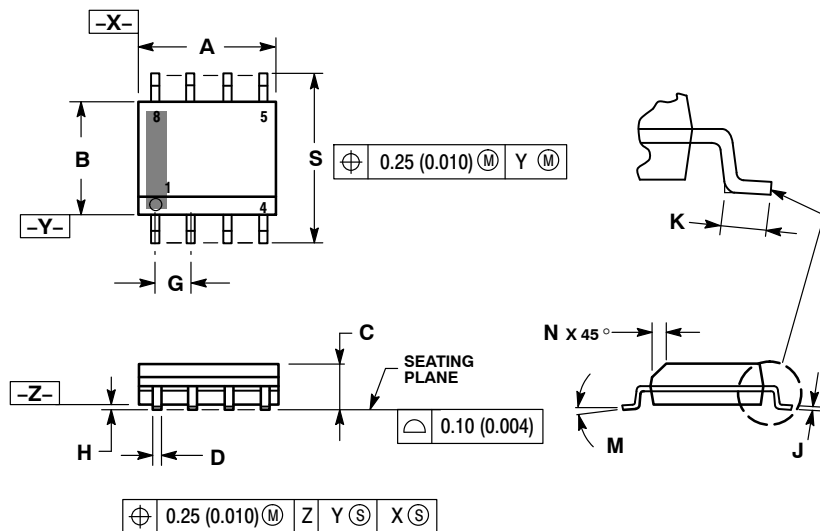
Figure 23. Schottky Thermal Response



SCALE 1:1

SOIC-8 NB
CASE 751-07
ISSUE AK

DATE 16 FEB 2011

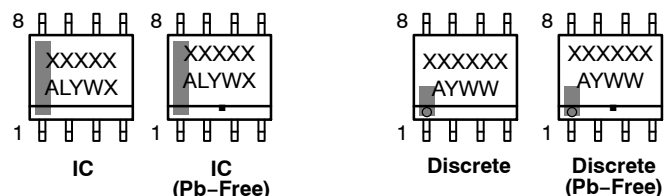
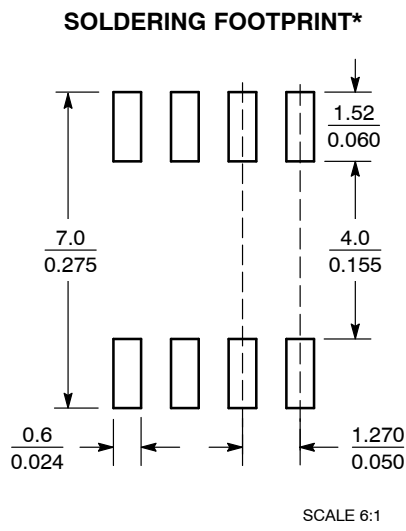


NOTES:

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.

DIM	MILLIMETERS		INCHES	
	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

GENERIC
MARKING DIAGRAM*



XXXXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb-Free Package

XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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

STYLES ON PAGE 2

DOCUMENT NUMBER:	98ASB42564B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOIC-8 NB	PAGE 1 OF 2

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SOIC-8 NB
CASE 751-07
ISSUE AK

DATE 16 FEB 2011

STYLE 1: PIN 1. EMITTER 2. COLLECTOR 3. COLLECTOR 4. EMITTER 5. EMITTER 6. BASE 7. BASE 8. EMITTER	STYLE 2: PIN 1. COLLECTOR, DIE, #1 2. COLLECTOR, #1 3. COLLECTOR, #2 4. COLLECTOR, #2 5. BASE, #2 6. EMITTER, #2 7. BASE, #1 8. EMITTER, #1	STYLE 3: PIN 1. DRAIN, DIE #1 2. DRAIN, #1 3. DRAIN, #2 4. DRAIN, #2 5. GATE, #2 6. SOURCE, #2 7. GATE, #1 8. SOURCE, #1	STYLE 4: PIN 1. ANODE 2. ANODE 3. ANODE 4. ANODE 5. ANODE 6. ANODE 7. ANODE 8. COMMON CATHODE
STYLE 5: PIN 1. DRAIN 2. DRAIN 3. DRAIN 4. DRAIN 5. GATE 6. GATE 7. SOURCE 8. SOURCE	STYLE 6: PIN 1. SOURCE 2. DRAIN 3. DRAIN 4. SOURCE 5. SOURCE 6. GATE 7. GATE 8. SOURCE	STYLE 7: PIN 1. INPUT 2. EXTERNAL BYPASS 3. THIRD STAGE SOURCE 4. GROUND 5. DRAIN 6. GATE 3 7. SECOND STAGE Vd 8. FIRST STAGE Vd	STYLE 8: PIN 1. COLLECTOR, DIE #1 2. BASE, #1 3. BASE, #2 4. COLLECTOR, #2 5. COLLECTOR, #2 6. EMITTER, #2 7. EMITTER, #1 8. COLLECTOR, #1
STYLE 9: PIN 1. EMITTER, COMMON 2. COLLECTOR, DIE #1 3. COLLECTOR, DIE #2 4. EMITTER, COMMON 5. EMITTER, COMMON 6. BASE, DIE #2 7. BASE, DIE #1 8. EMITTER, COMMON	STYLE 10: PIN 1. GROUND 2. BIAS 1 3. OUTPUT 4. GROUND 5. GROUND 6. BIAS 2 7. INPUT 8. GROUND	STYLE 11: PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. DRAIN 2 7. DRAIN 1 8. DRAIN 1	STYLE 12: PIN 1. SOURCE 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN
STYLE 13: PIN 1. N.C. 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN	STYLE 14: PIN 1. N-SOURCE 2. N-GATE 3. P-SOURCE 4. P-GATE 5. P-DRAIN 6. P-DRAIN 7. N-DRAIN 8. N-DRAIN	STYLE 15: PIN 1. ANODE 1 2. ANODE 1 3. ANODE 1 4. ANODE 1 5. CATHODE, COMMON 6. CATHODE, COMMON 7. CATHODE, COMMON 8. CATHODE, COMMON	STYLE 16: PIN 1. EMITTER, DIE #1 2. BASE, DIE #1 3. EMITTER, DIE #2 4. BASE, DIE #2 5. COLLECTOR, DIE #2 6. COLLECTOR, DIE #2 7. COLLECTOR, DIE #1 8. COLLECTOR, DIE #1
STYLE 17: PIN 1. VCC 2. V2OUT 3. V1OUT 4. TXE 5. RXE 6. VEE 7. GND 8. ACC	STYLE 18: PIN 1. ANODE 2. ANODE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. CATHODE 8. CATHODE	STYLE 19: PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. MIRROR 2 7. DRAIN 1 8. MIRROR 1	STYLE 20: PIN 1. SOURCE (N) 2. GATE (N) 3. SOURCE (P) 4. GATE (P) 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN
STYLE 21: PIN 1. CATHODE 1 2. CATHODE 2 3. CATHODE 3 4. CATHODE 4 5. CATHODE 5 6. COMMON ANODE 7. COMMON ANODE 8. CATHODE 6	STYLE 22: PIN 1. I/O LINE 1 2. COMMON CATHODE/VCC 3. COMMON CATHODE/VCC 4. I/O LINE 3 5. COMMON ANODE/GND 6. I/O LINE 4 7. I/O LINE 5 8. COMMON ANODE/GND	STYLE 23: PIN 1. LINE 1 IN 2. COMMON ANODE/GND 3. COMMON ANODE/GND 4. LINE 2 IN 5. LINE 2 OUT 6. COMMON ANODE/GND 7. COMMON ANODE/GND 8. LINE 1 OUT	STYLE 24: PIN 1. BASE 2. EMITTER 3. COLLECTOR/ANODE 4. COLLECTOR/ANODE 5. CATHODE 6. CATHODE 7. COLLECTOR/ANODE 8. COLLECTOR/ANODE
STYLE 25: PIN 1. VIN 2. N/C 3. REXT 4. GND 5. IOUT 6. IOUT 7. IOUT 8. IOUT	STYLE 26: PIN 1. GND 2. dv/dt 3. ENABLE 4. ILIMIT 5. SOURCE 6. SOURCE 7. SOURCE 8. VCC	STYLE 27: PIN 1. ILIMIT 2. OVLO 3. UVLO 4. INPUT+ 5. SOURCE 6. SOURCE 7. SOURCE 8. DRAIN	STYLE 28: PIN 1. SW_TO_GND 2. DASIC_OFF 3. DASIC_SW_DET 4. GND 5. V_MON 6. VBULK 7. VBULK 8. VIN
STYLE 29: PIN 1. BASE, DIE #1 2. EMITTER, #1 3. BASE, #2 4. EMITTER, #2 5. COLLECTOR, #2 6. COLLECTOR, #2 7. COLLECTOR, #1 8. COLLECTOR, #1	STYLE 30: PIN 1. DRAIN 1 2. DRAIN 1 3. GATE 2 4. SOURCE 2 5. SOURCE 1/DRAIN 2 6. SOURCE 1/DRAIN 2 7. SOURCE 1/DRAIN 2 8. GATE 1		

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