MOSFET – Power, P-Channel, SOIC-8

-30 V, -11.4 A

NTMS4177P

$V_{(BR)DSS}$	$R_{DS(on)}$ Max	I_D Max
−30 V	12 mΩ @ −10 V	−11.4 A
	19 mΩ @ −4.5 V	

SOIC−8
CASE 751
STYLE 12

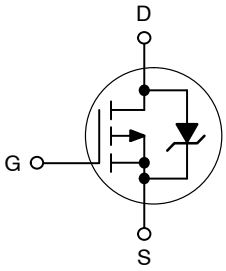
Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- SOIC−8 Surface Mount Package Saves Board Space
- This is a Pb−Free Device

Applications

- Load Switches
- Notebook PC's
- Desktop PC's

P−Channel



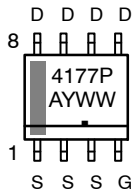
MAXIMUM RATINGS (T_J = 25°C unless otherwise stated)

Symbol	Rating			Value	Unit
V_{DSS}	Drain−to−Source Voltage			−30	V
V_{GS}	Gate−to−Source Voltage			±20	V
I_D	Continuous Drain Current $R_{\theta JA}$ (Note 1)	Steady State	T_A = 25°C	−8.9	A
			T_A = 70°C	−7.1	
P_D	Power Dissipation $R_{\theta JA}$ (Note 1)		T_A = 25°C	1.52	W
I_D	Continuous Drain Current $R_{\theta JA}$ (Note 2)		T_A = 25°C	−6.6	A
			T_A = 70°C	−5.3	
P_D	Power Dissipation $R_{\theta JA}$ (Note 2)		T_A = 25°C	0.84	W
I_D	Continuous Drain Current $R_{\theta JA}$ t < 10 s (Note 1)		T_A = 25°C	−11.4	A
			T_A = 70°C	−9.3	
P_D	Power Dissipation $R_{\theta JA}$ t < 10 s (Note 1)		T_A = 25°C	2.5	W
I_{DM}	Pulsed Drain Current	T_A = 25°C, t_p = 10 μs		−46	A
T_J, T_{STG}	Operating Junction and Storage Temperature			−55 to +150	°C
I_S	Source Current (Body Diode)			−2.1	A
EAS	Single Pulse Drain−to−Source Avalanche Energy T_J = 25°C, V_{DD} = 30 V, V_{GS} = 10 V, I_L = 20 A_{pk}, L = 1.0 mH, R_G = 25 Ω			200	mJ
T_L	Lead Temperature for Soldering Purposes (1/8″ from case for 10 s)			260	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Surface−mounted on FR4 board using 1 inch sq pad size, 1 oz Cu.
2. Surface−mounted on FR4 board using the minimum recommended pad size.

MARKING DIAGRAM & PIN ASSIGNMENT



4177P = Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

ORDERING INFORMATION

Device	Package	Shipping†
NTMS4177PR2G	SOIC−8 (Pb−Free)	2,500 / 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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THERMAL RESISTANCE RATINGS

Symbol	Rating	Max	Unit
$R_{\theta JA}$	Junction−to−Ambient – Steady State (Note 3)	82	°C/W
$R_{\theta JA}$	Junction−to−Ambient – t≤10 s (Note 3)	50	
$R_{\theta JF}$	Junction−to−FOOT (Drain)	20	
$R_{\theta JA}$	Junction−to−Ambient – Steady State (Note 4)	148	

3. Surface−mounted on FR4 board using 1 inch sq pad size, 1 oz Cu.
4. Surface−mounted on FR4 board using the minimum recommended pad size.

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)jk

Symbol	Characteristic	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
$V_{(BR)DSS}$	Drain−to−Source Breakdown Voltage	V_{GS} = 0 V, I_D = −250 μA		−30			V
$V_{(BR)DSS}/T_J$	Drain−to−Source Breakdown Voltage Temperature Coefficient				29		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0 V, V_{DS} = −24 V	T_J = 25°C			−1.0	μA
			T_J = 85°C			−5.0	
I_{GSS}	Gate−to−Source Leakage Current	V_{DS} = 0 V, V_{GS} = ±20 V				±100	nA
ON CHARACTERISTICS (Note 5)							
$V_{GS(TH)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = −250 μA		−1.5		−2.5	V
$V_{GS(TH)}/T_J$	Negative Threshold Temperature Coefficient				6.0		mV/°C
$R_{DS(on)}$	Drain−to−Source On Resistance	V_{GS} = −10 V	I_D = −11.4 A		10	12	mΩ
		V_{GS} = −4.5 V	I_D = −9.1 A		15	19	
g_{FS}	Forward Transconductance	V_{DS} = −1.5 V	I_D = −11.4 A		30		S
CHARGES, CAPACITANCES AND GATE RESISTANCE							
C_{ISS}	Input Capacitance	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = −24 V			3100		pF
C_{OSS}	Output Capacitance				550		
C_{RSS}	Reverse Transfer Capacitance				370		
$Q_{G(TOT)}$	Total Gate Charge	V_{GS} = −4.5 V, V_{DS} = −15 V, I_D = −11.4 A			29		nC
$Q_{G(TH)}$	Threshold Gate Charge				3.3		
Q_{GS}	Gate−to−Source Charge				10		
Q_{GD}	Gate−to−Drain Charge				13		
$Q_{G(TOT)}$	Total Gate Charge	V_{GS} = −10 V, V_{DS} = −15 V, I_D = −11.4 A,			55		nC
R_G	Gate Resistance				2.0	4.0	Ω
SWITCHING CHARACTERISTICS (Note 6)							
$t_{d(ON)}$	Turn−On Delay Time	V_{GS} = −10 V, V_{DD} = −15 V, I_D = −1.0 A, R_G = 6.0 Ω			18		ns
t_r	Rise Time				13		
$t_{d(OFF)}$	Turn−Off Delay Time				64		
t_f	Fall Time				36		
DRAIN−TO−SOURCE CHARACTERISTICS							
V_{SD}	Forward Diode Voltage	V_{GS} = 0 V I_D = −2.1 A	T_J = 25°C		−0.73	−1.0	V
			T_J = 125°C		0.54		ns
t_{RR}	Reverse Recovery Time	V_{GS} = 0 V, d_{IS}/d_t = 100 A/μs, I_S = −2.1 A			34		
T_a	Charge Time				18		
T_b	Discharge Time				16		
Q_{RR}	Reverse Recovery Time				30		nC

5. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.

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TYPICAL PERFORMANCE CURVES

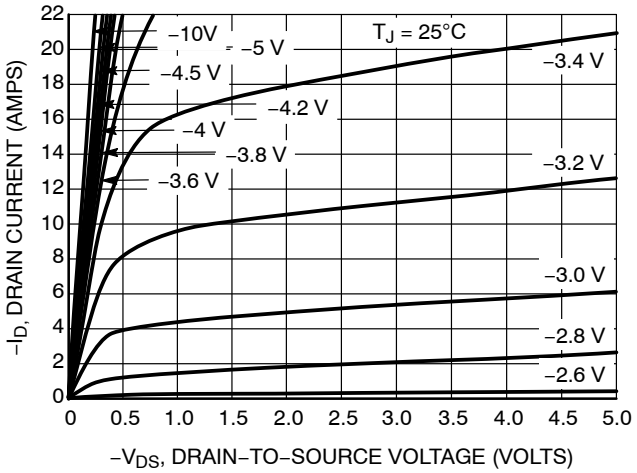

Figure 1. On–Region Characteristics

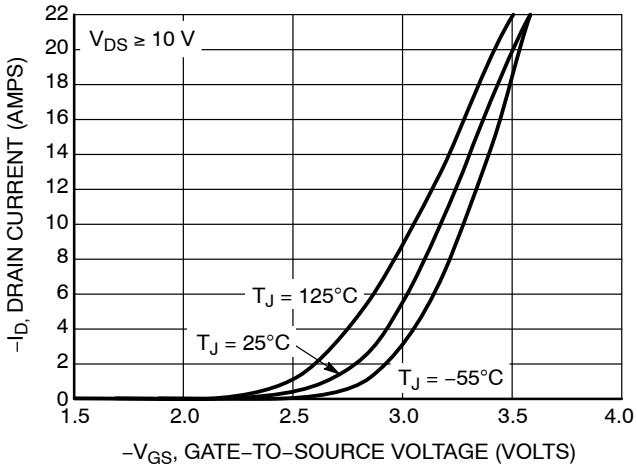

Figure 2. Transfer Characteristics

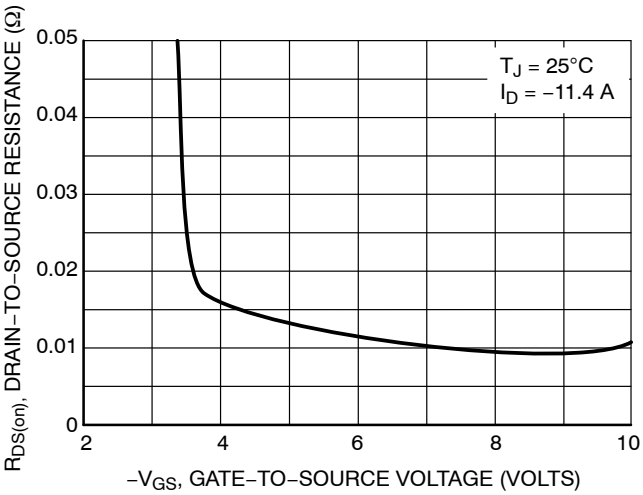

Figure 3. On–Resistance vs. Gate–to–Source Voltage

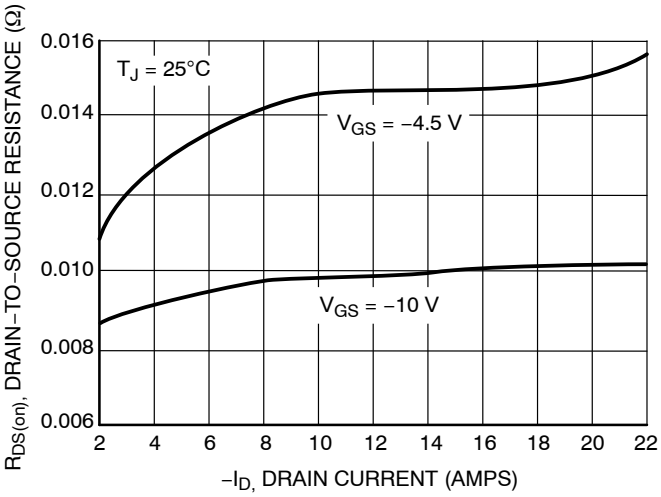

Figure 4. On–Resistance vs. Drain Current and Gate Voltage

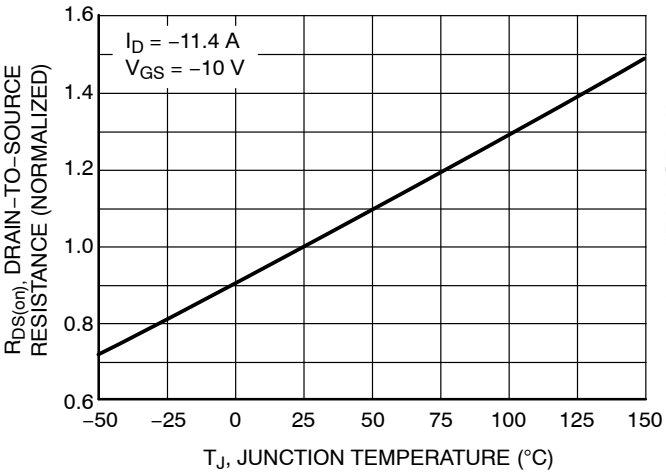

Figure 5. On–Resistance Variation with Temperature

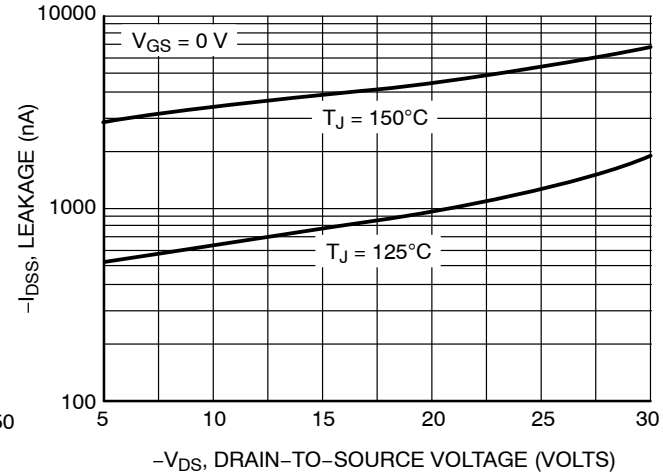

Figure 6. Drain–to–Source Leakage Current vs. Voltage

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TYPICAL PERFORMANCE CURVES (continued)

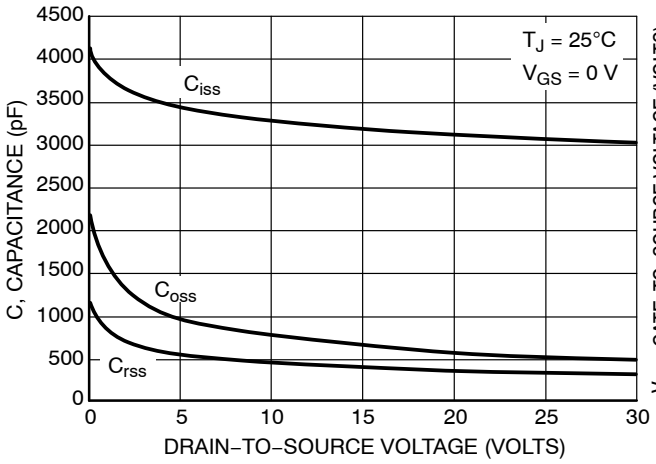

Figure 7. Capacitance Variation

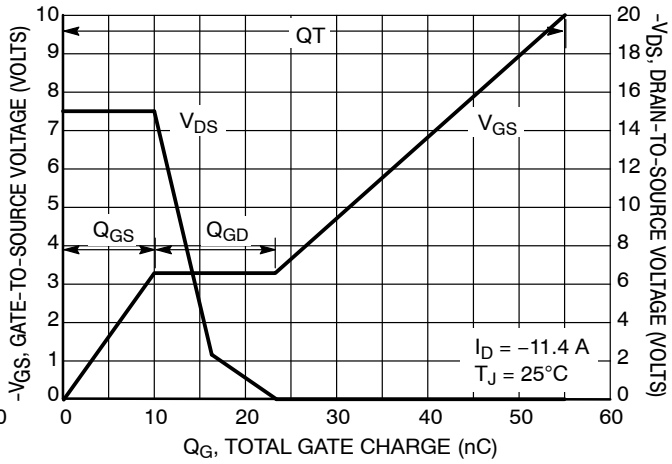

Figure 8. Gate−To−Source and Drain−To−Source Voltage vs. Total Charge

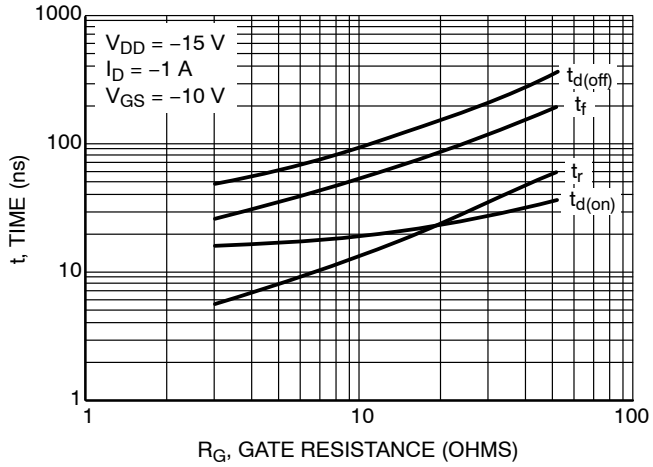

Figure 9. Resistive Switching Time Variation vs. Gate Resistance

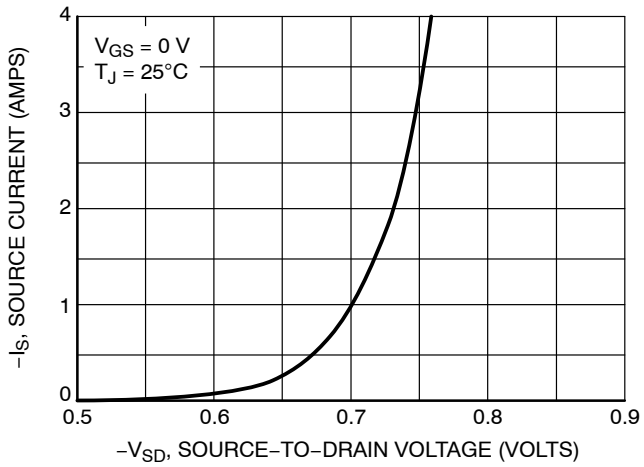

Figure 10. Diode Forward Voltage vs. Current

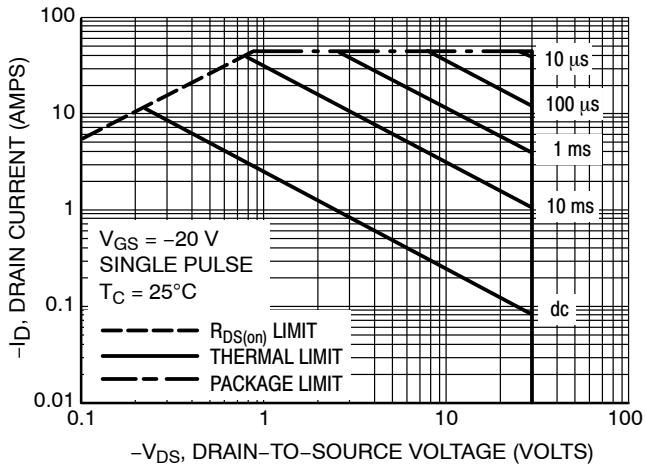

Figure 11. Maximum Rated Forward Biased Safe Operating Area

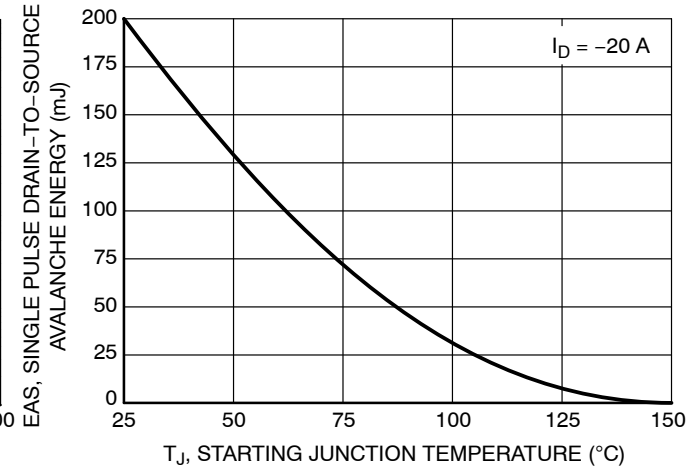

Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

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SCALE 1:1

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ISSUE AK

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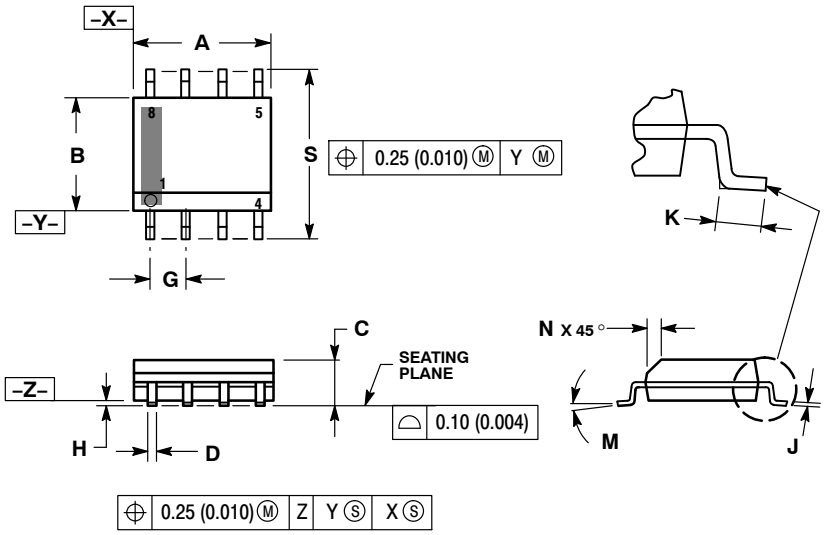
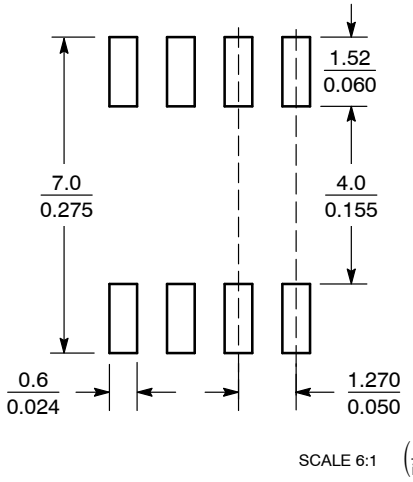


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005)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

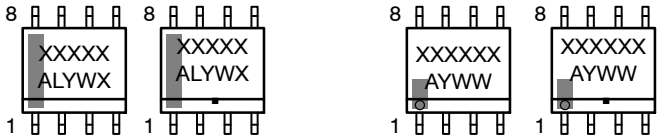
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0 °	8 °	0 °	8 °
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

SOLDERING FOOTPRINT*



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

GENERIC MARKING DIAGRAM*



XXXXX = 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.

STYLES ON PAGE 2

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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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