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NTE7189, NTE7190, NTE7191, NTE7192, NTE7193, NTE7194 & NTE7195
Integrated Circuit
Pulse Width Modulator (PWM) Switch for TVs, Monitors and Audio Amplifiers

Description:

The NTE7189 thru NTE7195 are off–line pulse width modulator switches in a TO220 type package bringing many new enhancements that reduce the sensitivity to board layout and line transients making design even easier. These devices incorporate all the functions necessary for a switched mode control system into a three terminal monolithic IC: power MOSFET, PWM controller, high voltage start up circuit, loop compensation and fault protection circuitry.

Features:

- Cost Competitive with Linears Above 5W
- Very Low AC/DC Losses – Up to 90% Efficiency
- Built–In Auto–Restart and Current Limiting
- Latching Thermal Shutdown for System Level Protection
- Implements Flyback, Forward, Boost or Buck Topology
- Works with Primary or Opto Feedback
- Stable in Discontinuous or Continuous Conduction Mode
- Source Connected Tab for Low EMI

Absolute Maximum Ratings: (T_A = +25°C, All Voltages Referenced to Source unless otherwise specified)

Drain Voltage . . . . –0.3V to +700V
Drain Current Increase (ΔI_p) in 100ns except during blanking time (Note 1) . . . . . 0.1 x $I_{LIMIT(MAX)}$
Control Voltage . . . . –0.3V to +9V
Control Current 100mA

Note 1. Related to transformer saturation.

Absolute Maximum Ratings (Cont'd): (T_A = +25°C, All Voltages Referenced to Source unless otherwise specified)

Power Output Level, P_{MAX}

Single Voltage Input (100/115/230 VAC, ±15%, Note 2, Note 3, Note 4)

NTE7189 . . . . 12W
NTE7190 . . . . 25W
NTE7191 . . . . 50W
NTE7192 . . . . 75W
NTE7193 . . . . 100W
NTE7194 . . . . 125W
NTE7195 . . . . 150W

Wide Range Input (85 to 265 VAC, Note 3, Note 4)

NTE7189 . . . . 7W
NTE7190 . . . . 15W
NTE7191 . . . . 30W
NTE7192 . . . . 45W
NTE7193 . . . . 60W
NTE7194 . . . . 75W
NTE7195 . . . . 90W

Operating Junction Temperature (Note 5), T_j . . . . −40° to +150°C
Storage Temperature Range, T_{stg} . . . . −65° to +150°C
Lead Temperature (During Soldering, 1/16" from case, 5sec max.), T_L . . . . +260°C
Maximum Thermal Resistance, Junction−to−Ambient (Note 6), R_{thJA} . . . . +70°C/W
Maximum Thermal Resistance, Junction−to−Case (Note 7), R_{thJC} . . . . +2°C/W

Note 2. 110/115 VAC with doubler input.
Note 3. Assumes appropriate heat sinking to keep the maximum junction temperature below 100°C
Note 4. P_{MAX} is the maximum practical continuous power output level for conditions shown. The continuous power capability is a given application depends on thermal environment, transformer design, efficiency required, minimum specified input voltage, input storage capacitance, etc.
Note 5. Normally limited by internal circuitry.
Note 6. Free standing with no heatsink.
Note 7. Measured at tab closest to plastic interface or Source pin.

Electrical Characteristics: (Source = 0V, T_J = −40° to +125°C unless otherwise specified)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Control Functions							
Output Frequency	f_{OSC}	I_C = 4mA, T_J = +25°C		90	100	110	kHz
Maximum Duty Cycle	D_{MAX}	$I_C = I_{CD1}$ + 0.4mA		64	67	70	%
Minimum Duty Cycle	D_{MIN}	I_C = 10mA		0.7	1.7	2.7	%
PWM Gain		I_C = 4mA, T_J = +25°C		–21	–16	–11	%/mA
PWM Gain Temperature Drift				–	–0.05	–	%/mA/°C
External Bias Current	I_B			0.8	2.0	3.3	mA
Dynamic Impedance	Z_C	I_C = 4mA, T_J = +25°C		10	15	22	W
Dynamic Impedance Temperature Drift				–	0.18	–	%/°C
Shutdown/Auto−Restart							
Control Pin Charging Current	I_C	T_J = +25°C	V_C = 0V	–2.4	–1.9	–1.2	mA
			V_C = 5V	–2	–1.5	–0.8	
Charging Current Temperature Drift		Note 8		–	0.4	–	%/°C

Note 8. For specifications with negative values, a negative temperature coefficient corresponds to an increase in magnitude with increasing temperature, and a positive temperature coefficient corresponds to a decrease in magnitude with increasing temperature.

Electrical Characteristics (Cont'd): (Source = 0V, T_J = −40° to +125°C unless otherwise specified)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Shutdown/Auto−Restart (Cont'd)							
Auto−Restart Threshold Voltage	$V_{C(AR)}$	S1 open		–	5.7	–	V
UV Lockout Threshold Voltage		S1 open		4.4	4.7	5.0	V
Auto−Restart Hysteresis Voltage		S1 open		0.6	1.0	–	V
Auto−Restart Duty Cycle NTE7189, NTE7190		S1 open		2	5	9	%
All Other Devices				2	5	8	
Auto−Restart Frequency		S1 open		–	1.2	–	Hz
Circuit Protection							
Self−Protection Current Limit NTE7189	I_{LIMIT}	di/dt = 40mA/µs	T_J = +25°C	0.23	0.25	0.28	A
NTE7190		di/dt = 80mA/µs		0.45	0.50	0.55	A
NTE7191		di/dt = 160mA/µs		0.90	1.00	1.10	A
NTE7192		di/dt = 240mA/µs		1.35	1.50	1.65	A
NTE7193		di/dt = 320mA/µs		1.80	2.00	2.20	A
NTE7194		di/dt = 400mA/µs		2.25	2.50	2.75	A
NTE7195		di/dt = 480mA/µs		2.70	3.00	3.30	A
Initial Current Limit	I_{INIT}	≤ 85VAC (Rectified Line Input)	T_J = +25°C	0.75 x $I_{LIMIT(MIN)}$	–	–	A
		≤ 265VAC (Rectified Line Input)		0.6 x $I_{LIMIT(MIN)}$	–	–	A
Leading Edge Blanking Time	t_{LEB}	I_C = 4mA, T_J = +25°C		–	180	–	ns
Current Limit Delay	t_{ILD}	I_C = 4mA		–	100	–	ns
Thermal Shutdown Temperature		I_C = 4 mA		125	135	–	°C
Power−Up Reset Threshold Voltage	$V_{C(RESET)}$	S2 open		2.0	3.3	4.3	V
Output							
On−State Resistance NTE7189	$R_{DS(ON)}$	I_D = 25mA	T_J = +25°C	–	31.2	36.0	W
			T_J = +100°C	–	51.4	60.0	W
NTE7190		I_D = 50mA	T_J = +25°C	–	15.6	18.0	W
			T_J = +100°C	–	25.7	30.0	W
NTE7191		I_D = 100mA	T_J = +25°C	–	7.8	9.0	W
			T_J = +100°C	–	12.9	15.0	W
NTE7192		I_D = 150mA	T_J = +25°C	–	5.2	6.0	W
			T_J = +100°C	–	8.6	10.0	Ω
NTE7193		I_D = 200mA	T_J = +25°C	–	3.9	4.5	W
			T_J = +100°C	–	6.4	7.5	W
NTE7194		I_D = 250mA	T_J = +25°C	–	3.1	3.6	W
			T_J = +100°C	–	5.2	6.0	W
NTE7195		I_D = 300mA	T_J = +25°C	–	2.6	3.0	W
			T_J = +100°C	–	4.3	5.0	W

Electrical Characteristics (Cont'd): (Source = 0V, T_J = −40° to +125°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output (Cont'd)						
OFF−State Current	I_{DSS}	V_{DS} = 560V, T_A = +125°C, Note 9	–	–	250	μA
Breakdown Voltage	BV_{DSS}	I_D = 100μA, T_A = +25°C, Note 9	700	–	–	V
Rise Time	t_R	Measured in a Typical Flyback Converter Application.	–	100	–	ns
Fall Time	t_F		–	50	–	ns
Drain Supply Voltage		Note 10	36	–	–	V
Shunt Regulator Voltage	$V_{C(SHUNT)}$	I_C = 4mA	5.5	5.7	6.0	V
Shunt Regulator Temperature Drift			–	±50	–	ppm/°C
Control Supply/Discharge Current NTE7189 thru NTE7192	I_{CD1}	Output MOSFET Enabled	0.6	1.2	1.6	mA
NTE7193, NTE7194, NTE7195			0.7	1.4	1.8	mA
All Devices	I_{CD2}	Output MOSFET Disabled	0.5	0.8	1.1	mA

Note 9. The breakdown voltage and leakage current measurements can be accomplished by using the following sequence:

i. The curve tracer should initially be set at 0V. The base output should be adjusted through a voltage sequence of 0V, 6.5V, 4.3V, and 6.5V. The base current from the curve tracer should not exceed 100mA. This CONTROL pin sequence interrupts the Auto−Restart sequence and llocks the internal MOSFET in the OFF state.

ii. The breakdown and leakage measurements can now be taken with the curve tracer. The maximum voltage from the curve tracer must be limited to 700V under all conditions.

Note 10. It is possible to start up and operate at DRAIN voltages well below 36V. However, the CONTROL pin charging current is reduced, which affects start−up time, auto−restart frequency, and auto−restart duty cycle.