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MIC2289-15YML-TR

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MIC2289

White LED Driver Internal Schottky Diode and OVP

Features

- 2.5V to 10V Input Voltage Range
- Output Voltage up to 34V
- Internal Schottky Diode
- 15V, 24V, 34V Output OVP Options
- 1.2 MHz PWM Operation
- Over 500 mA Switch Current
- 95 mV Feedback Voltage
- <1% Line and Load Regulation
- <1 µA Shutdown Current
- Overtemperature Protection
- UVLO
- 6-Pin Thin SOT-23 and 2 mm x 2 mm DFN-8 Package Options
- –40°C to +125°C Junction Temperature Range

Applications

- White LED Driver for Backlighting:
  - Cell Phones
  - PDAs
  - GPS Systems
  - Digital Cameras
  - MP3 Players
  - IP Phones
- LED Flashlights
- Constant Current Power Supplies

General Description

The MIC2289 is a PWM (pulse width modulated), boost-switching regulator that is optimized for constant current white LED driver applications. The MIC2289 features an internal Schottky diode and three levels of output overvoltage protection providing a small size and efficient DC/DC solution that requires only four external components.

To optimize efficiency, the feedback voltage is set to only 95 mV. This reduces power dissipation in the current setting resistor and allows the lowest total output voltage, hence minimizes current draw from the battery.

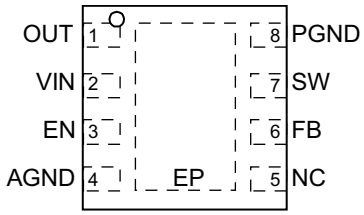
The MIC2289 implements a constant frequency 1.2 MHz PWM control scheme. The high frequency, PWM operation saves board space by reducing external component sizes. The added benefit of the constant frequency PWM scheme in comparison to variable frequency is much lower noise and input ripple injected to the input power source.

The MIC2289 clamps the output voltage in case of open LED conditions, protecting itself and the output capacitor. The MIC2289 is available with three output OVP options of 15V, 24V, and 34V. The different OVP options allows the use of the smallest possible output capacitor with the appropriate voltage rating for a given application.

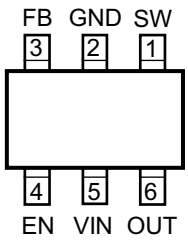
The MIC2289 is available in low profile 6-pin Thin SOT-23 and 8-pin 2 mm × 2 mm DFN package options. The MIC2289 has a junction temperature range of –40°C to +125°C.

Package Types

MIC2289
DFN-8 (ML)
(Top View)

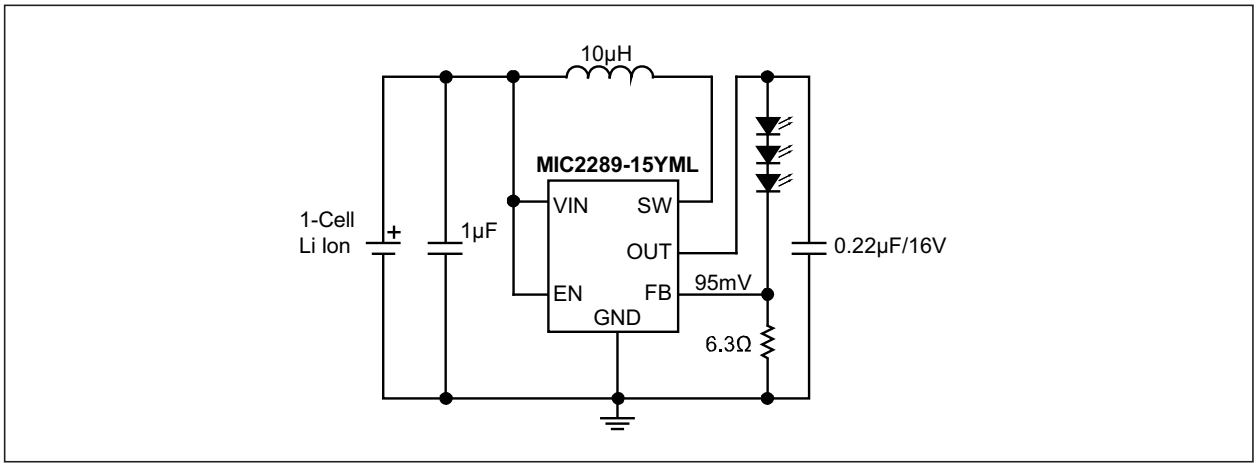


MIC2289
Thin SOT23-6 (D6)
(Top View)

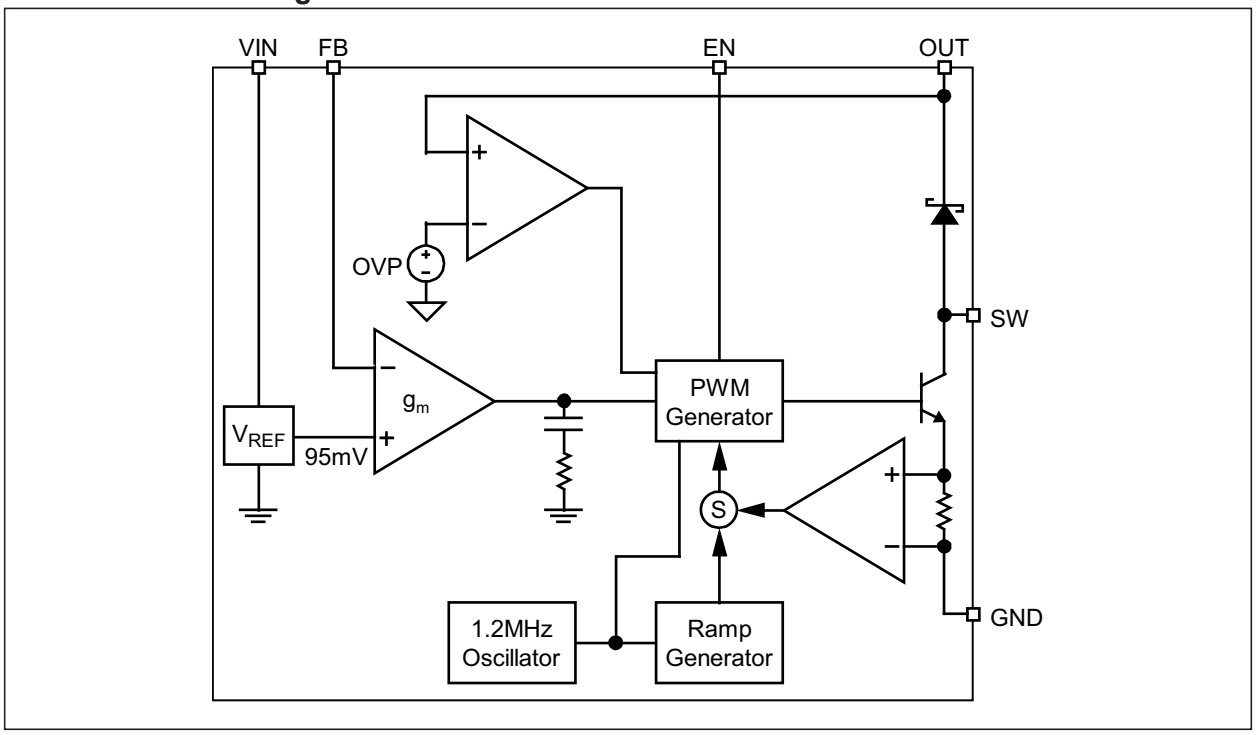


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Typical Application Circuit



Functional Block Diagram



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1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Supply Voltage (V_{IN}) ..... +12V
Switch Voltage (V_{SW}) ..... –0.3V to +34V
Enable Pin Voltage (V_{EN}) ..... –0.3V to V_{IN}
FB Voltage (V_{FB}) ..... +6.0V
Switch Current (I_{SW}) 2A
Schottky Reverse Voltage (V_{DR}) 34V
Ambient Storage Temperature Range (T_S) ..... –65°C to +150°C
ESD Rating (Note 1) ..... 2 kV

Operating Ratings ††

Supply Voltage (V_{IN}) ..... +2.5V to +10V
Output Voltage (V_{OUT}) ..... V_{IN} to V_{OVP}
Junction Temperature Range (T_J) ..... –40°C to +125°C
Package Thermal Resistance
2 mm x 2 mm DFN (θ_{JA}) ..... 93°C/W
Thin SOT23-6 (θ_{JA}) ..... 177°C/W

† Notice: Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

†† Notice: The device is not guaranteed to function outside its operating ratings.

Note 1: Devices are ESD sensitive. Handling precautions are recommended. Human body model, 1.5 kΩ in series with 100 pF.

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ELECTRICAL CHARACTERISTICS

Electrical Characteristics: T_A = +25°C, V_{IN} = V_{EN} = 3.6V, V_{OUT} = 10V, I_{OUT} = 20 mA, unless otherwise noted. **Bold** values indicate –40°C ≤ T_J ≤ ±125°C. Note 1

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Supply Voltage Range	V_{IN}	**2.5**	—	**10**	V	—
Undervoltage Lockout	V_{UVLO}	1.8	2.1	2.4	V	—
Quiescent Current	I_{VIN}	—	2.5	5	mA	V_{FB} > 200 mV, not switching
Shutdown Current	I_{SD}	—	0.1	**1**	µA	V_{EN} = 0V, Note 2
Feedback Voltage	V_{FB}	90	95	100	mV	±5%
Feedback Input Current	I_{FB}	—	–450	—	nA	V_{FB} = 95 mV
Line Regulation	—	—	0.5	1	%	3V ≤ V_{IN} ≤ 5V, Note 3
Load Regulation	—	—	0.5	—	%	5 mA ≤ I_{OUT} ≤ 20 mA, Note 3
Maximum Duty Cycle	D_{MAX}	**85**	90	—	%	—
Switch Current Limit	$I_{SW(LIM)}$	—	750	—	mA	—
Switch Saturation Voltage	$V_{SW(SAT)}$	—	450	—	mV	I_{SW} = 0.5A
Switch Leakage Current	$I_{SW(LK)}$	—	0.01	**5**	µA	V_{EN} = 0V, V_{SW} = 10V
Enable Logic Level High	V_{EN_H}	**1.5**	—	—	V	Turn on
Enable Logic Level Low	V_{EN_L}	—	—	**0.4**		Turn off
Enable Pin Current	I_{EN}	—	20	40	µA	V_{EN} = 10V
Oscillator Frequency	f_{SW}	1.05	1.2	1.35	MHz	—
Schottky Forward Drop	V_D	—	0.8	1	V	I_D = 150 mA
Schottky Leakage Current	I_{RD}	—	—	**4**	µA	V_R = 30V
Output Overvoltage Protection	V_{OVP}	13	14	16	V	MIC2289-15
		21	22.5	24		MIC2289-24
		30	32	34		MIC2289-34
Overtemperature Shutdown Threshold	T_{SD}	—	150	—	°C	—
Overtemperature Shutdown Hysteresis	T_{SD_HYS}	—	10	—		Hysteresis

Note 1: Specification for packaged product only.

2: I_{SD} = Current drawn by the device into the VIN pin during shutdown.

3: Guaranteed by design.

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TEMPERATURE SPECIFICATIONS

Parameters	Symbol	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Junction Operating Temperature	T_J	–40	—	+125	°C	—
Maximum Junction Temperature	$T_{J(ABS)}$	—	—	+150	°C	—
Storage Temperature Range	T_S	–65	—	+150	°C	—
Package Thermal Resistances						
Thermal Resistance, 2x2 DFN 8-Lead	θ_{JA}	—	93	—	°C/W	—
Thermal Resistance, TSOT23-6	θ_{JA}	—	177	—	°C/W	—

Note 1: The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature and the thermal resistance from junction to air (i.e., T_A, T_J, θ_{JA}). Exceeding the maximum allowable power dissipation will cause the device operating junction temperature to exceed the maximum +125°C rating. Sustained junction temperatures above +125°C can impact the device reliability.

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2.0 TYPICAL PERFORMANCE CURVES

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

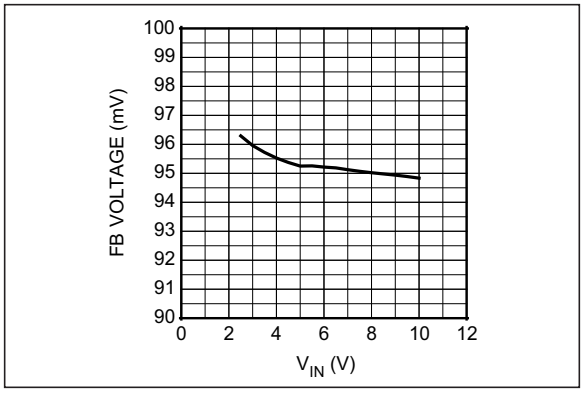


FIGURE 2-1: *Feedback Voltage vs. Input Voltage.*

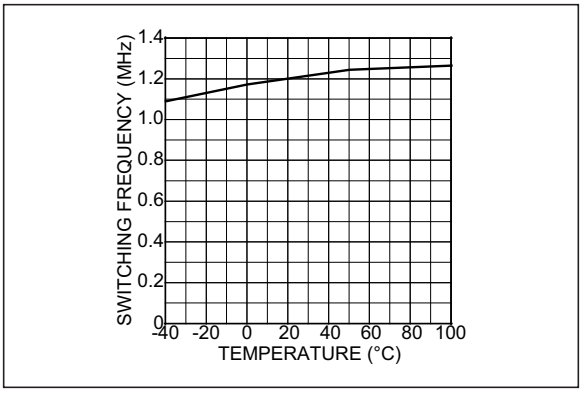


FIGURE 2-4: *Switch Frequency vs. Temperature.*

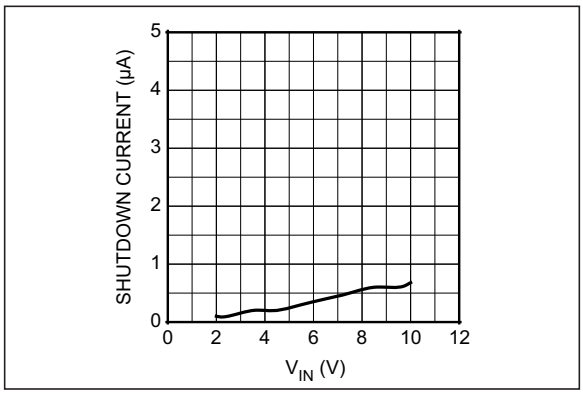


FIGURE 2-2: *Shutdown Current vs. Input Voltage.*

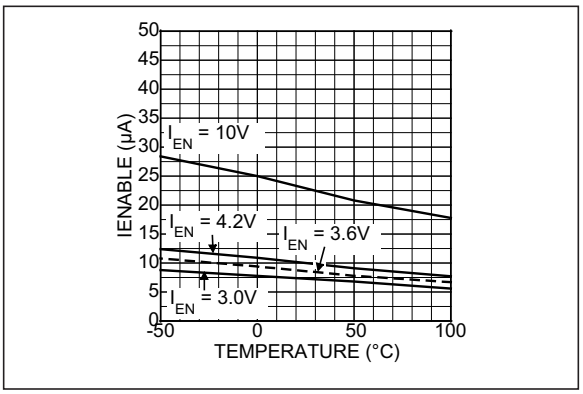


FIGURE 2-5: *EN Pin Bias Current vs. Temperature.*

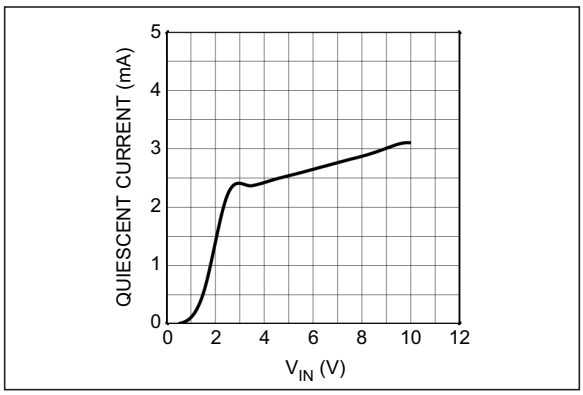


FIGURE 2-3: *Quiescent Current vs. Input Current.*

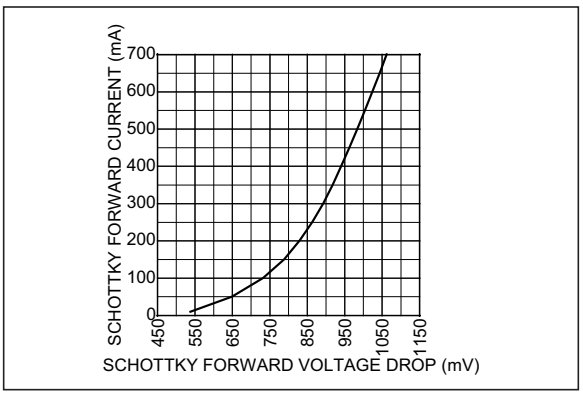


FIGURE 2-6: *Schottky Forward Voltage Drop.*

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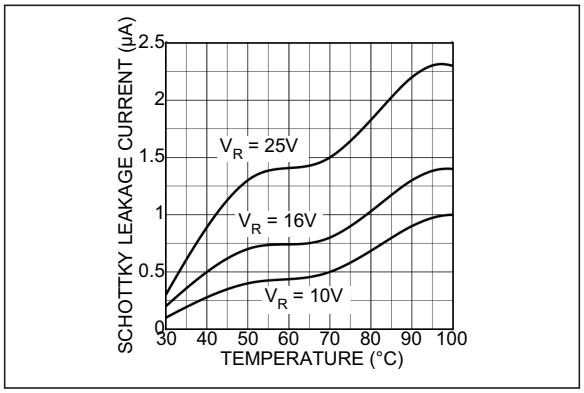


FIGURE 2-7: *Schottky Reverse Leakage Current.*

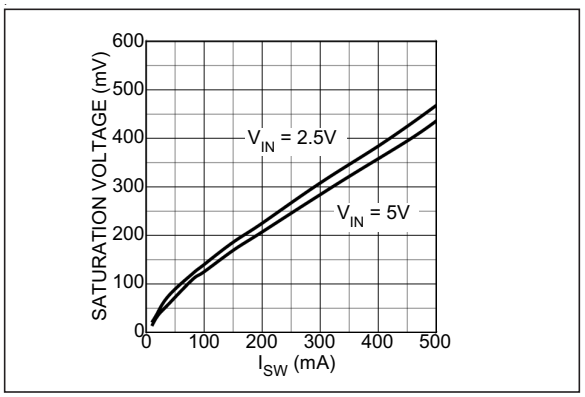


FIGURE 2-10: *Switch Saturation Voltage vs. Current.*

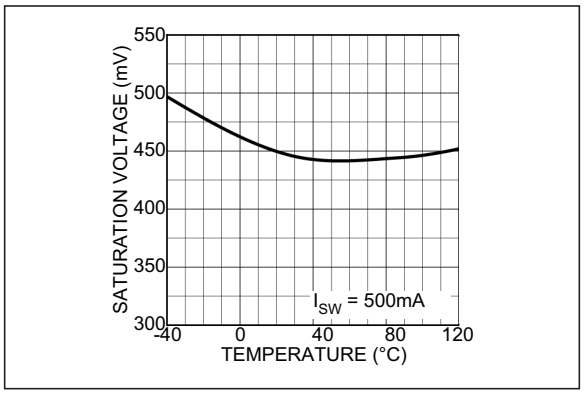


FIGURE 2-8: *Saturation Voltage vs. Temperature.*

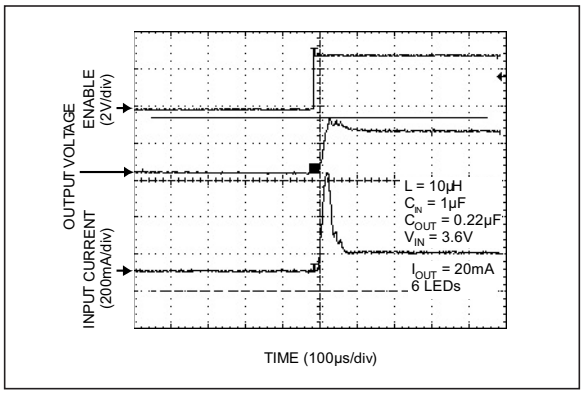


FIGURE 2-11: *6-Series LED Circuit without External Soft-Start.*

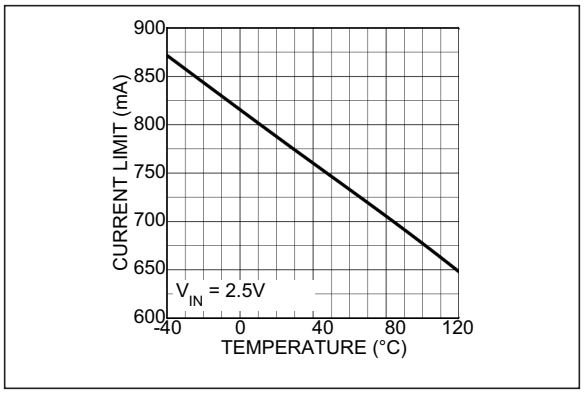


FIGURE 2-9: *Current Limit vs. Temperature.*

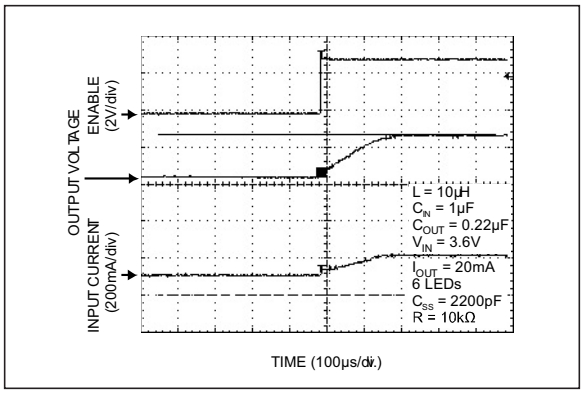


FIGURE 2-12: *6-Series LED Circuit with External Soft-Start.*

3.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 3-1.

TABLE 3-1: PIN FUNCTION TABLE

Pin Number TSOT23-6	Pin Number DFN-8	Pin Name	Description
1	7	SW	Switch Node (Input): Internal power bipolar collector.
2	—	GND	Ground (Return): Ground.
3	6	FB	Feedback (Input): Output voltage sense node. Connect the cathode of the LED to this pin. A resistor from this pin to ground sets the LED current.
4	3	EN	Enable (input): Logic high enables regulator. Logic low shuts down regulator. Do not leave floating.
5	2	VIN	Supply (Input): 2.5V to 10V for internal circuitry.
6	1	OUT	Output Pin and Overvoltage Protection (Output): Connect to the output capacitor and LEDs.
—	4	AGND	Analog ground.
—	8	PGND	Power ground.
—	5	NC	No connect (no internal connection to die).
—	EP	GND	Ground (Return): Exposed backside pad.

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4.0 FUNCTIONAL DESCRIPTION

The MIC2289 is a constant frequency, PWM current mode boost regulator. See the Functional Block Diagram. The MIC2289 is composed of an oscillator, slope compensation ramp generator, current amplifier, g_m error amplifier, PWM generator, and a 500 mA bipolar output transistor. The oscillator generates a 1.2 MHz clock. The clock's two functions are to trigger the PWM generator that turns on the output transistor and to reset the slope compensation ramp generator. The current amplifier is used to measure the switch current by amplifying the voltage signal from the internal sense resistor. The output of the current amplifier is summed with the output of the slope compensation ramp generator to generate the slope compensated ramp signal. This summed current-loop signal is fed to one of the inputs of the PWM generator.

The g_m error amplifier measures the LED current through the external sense resistor and amplifies the error between the detected signal and the 95 mV reference voltage. The output of the g_m error amplifier provides the voltage loop signal that is fed to the other input of the PWM generator. When the current-loop signal exceeds the voltage loop signal, the PWM generator turns off the bipolar output transistor. The next clock period initiates the next switching cycle, maintaining the constant frequency current mode PWM control. The LED current is set by the feedback resistor:

EQUATION 4-1:

$$I_{LED} = \frac{95mV}{R_{FB}}$$

The Enable pin shuts down the output switching and disables control circuitry to reduce VIN pin input current to leakage current level. Enable pin input current is zero at zero volt.

4.1 Dimming Control

There are two techniques for dimming control. One is PWM dimming, and the other is continuous dimming.

1. PWM dimming control is implemented by applying a PWM signal on EN pin as shown in Figure 4-1. The MIC2289 is turned on and off by the PWM signal. With this method, the LEDs operate with either zero or full current. The average LED current is increased proportionally to the duty-cycle of the PWM signal. This technique has high efficiency because the IC and the LEDs consume no current during the off-cycle of the PWM signal. Typical frequency should be between 100 Hz and 10 kHz.
2. Continuous dimming control is implemented by applying a DC control voltage to the FB pin of the MIC2289 through a series resistor as shown in Figure 4-2. The LED current is decreased proportionally with the amplitude of the control voltage. The LED intensity (current) can be dynamically varied applying a DC voltage to the FB pin. The DC voltage can come from a DAC signal, or a filtered PWM signal. The advantage of this approach is that a high frequency PWM signal (>10 kHz) can be used to control LED intensity.

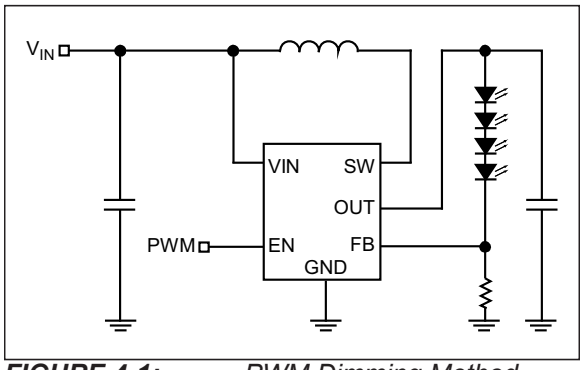


FIGURE 4-1: *PWM Dimming Method.*

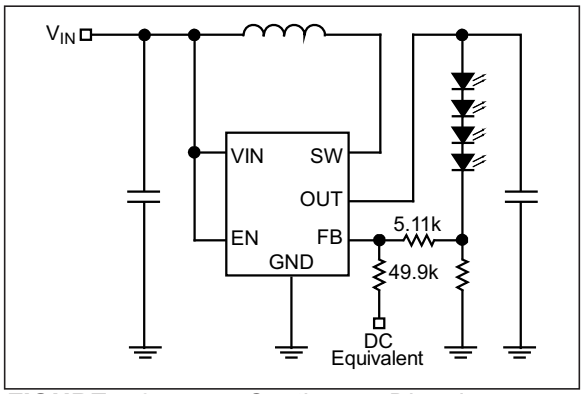


FIGURE 4-2: *Continuous Dimming.*

4.2 Open Circuit Protection

If the LEDs are disconnected from the circuit, or in case an LED fails open, the sense resistor will pull the FB pin to ground. This will cause the MIC2289 to switch with a high duty cycle, resulting in output overvoltage. This may cause the SW pin voltage to exceed its maximum voltage rating, possibly damaging the IC and the external components. To ensure the highest level of protection, the MIC2289 has three product options in the 2 mm × 2 mm DFN-8 with overvoltage protection, OVP. The OUT pin of the MIC2289 allows a dedicated OVP monitor with options for 15V, 24V, or 34V (see Figure 4-3). The reason for the three OVP levels is to let users choose the suitable level of OVP for their application. For example, a 3-LED application would typically see an output voltage of no more than 12V, so

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a 15V OVP option would offer a suitable level of protection. This allows the user to select the output diode and capacitor with the lowest voltage ratings, therefore smallest size and lowest cost. The OVP will clamp the output voltage to within the specified limits.

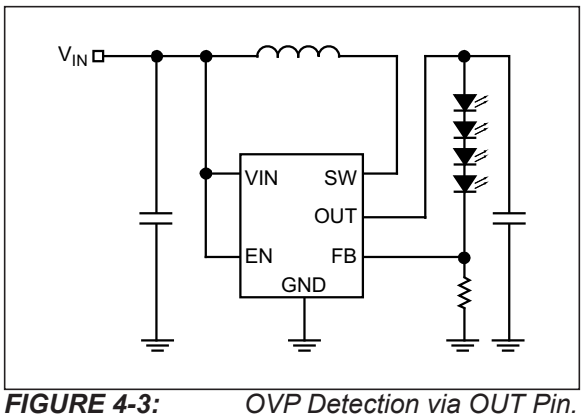


FIGURE 4-3: *OVP Detection via OUT Pin.*

4.3 Start-Up and Inrush Current

During start-up, inrush current of approximately double the nominal current flows to set up the inductor current and the voltage on the output capacitor. If the inrush current needs to be limited, a soft-start circuit similar to Figure 4-4 could be implemented. The soft-start capacitor, C_{SS}, provides over drive voltage to the FB pin at start-up, resulting in gradual increase of switch duty cycle and limited inrush current.

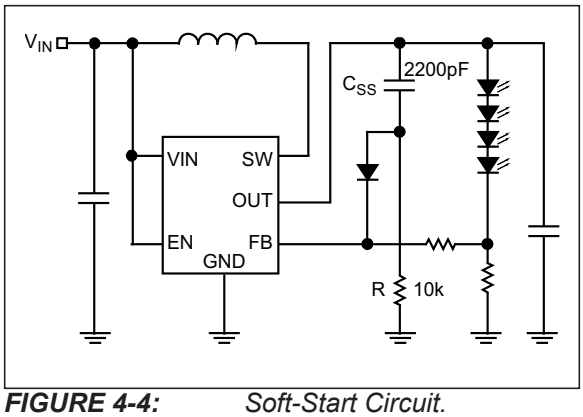


FIGURE 4-4: *Soft-Start Circuit.*

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5.0 EXTERNAL COMPONENT SELECTION

The MIC2289 can be used across a wide rage of applications. The table below shows recommended inductor and output capacitor values for various series-LED applications.

TABLE 5-1: EXTERNAL COMPONENT SELECTION

Series LEDs	L	Part #	Manufacturer	Min. C_{OUT}	Part #	Manufacturer
2	22 µH	LQH43MN220K03L	Murata	2.2 µF, 10V	0805ZD225KAT2A	AVX
		NLC453232T-220K-PF	TDK		GRM21BR61A225KA01L	Murata
	15 µH	LQH43MN150K03L	Murata	1 µF, 10V	0805ZD105KAT2A	AVX
		NLC453232T-150K-PF	TDK		GRM21BR61A105KA01L	Murata
	10 µH	LQH43MN100K03L	Murata	0.22 µF, 10V	0805ZD224KAT2A	AVX
		NLC453232T-100K-PF	TDK		GRM21BR71C224KA36L	Murata
	6.8 µH	LQH43MN6R8K03L	Murata	0.22 µF, 10V	0805ZD224KAT2A	AVX
		NLC453232T-6R8K-PF	TDK		GRM21BR71C224KA36L	Murata
	4.7 µH	LQH43MN4R7K03L	Murata	0.22 µF, 10V	0805ZD224KAT2A	AVX
		NLC453232T-4R7K-PF	TDK		GRM21BR71C224KA36L	Murata
3	22 µH	LQH43MN220K03L	Murata	2.2 µF, 16V	0805YD225KAT2A	AVX
		NLC453232T-220K-PF	TDK		GRM21BR71C225KA12L	Murata
	15 µH	LQH43MN150K03L	Murata	1 µF, 16V	0805YD105KAT2A	AVX
		NLC453232T-150K-PF	TDK		GRM21BR71C105KA01L	Murata
	10 µH	LQH43MN100K03L	Murata	0.22 µF, 16V	0805YC224KAT2A	AVX
		NLC453232T-100K-PF	TDK		GRM21BR71C224KA36L	Murata
	6.8 µH	LQH43MN6R8K03L	Murata	0.22 µF, 16V	0805YC224KAT2A	AVX
		NLC453232T-6R8K-PF	TDK		GRM21BR71C224KA36L	Murata
	4.7 µH	LQH43MN4R7K03L	Murata	0.27 µF, 16V	0805YC274KAT2A	AVX
		NLC453232T-4R7K-PF	TDK		C0805C274K4RACTU	Kemet
4	22 µH	LQH43MN220K03L	Murata	1 µF, 25V	08053D105KAT2A	AVX
		NLC453232T-220K-PF	TDK		C0805C105K3RACTU	Kemet
	15 µH	LQH43MN150K03L	Murata	1 µF, 25V	08053D105KAT2A	AVX
		NLC453232T-150K-PF	TDK		C0805C105K3RACTU	Kemet
	10 µH	LQH43MN100K03L	Murata	0.27 µF, 25V	08053C274KAT2A	AVX
		NLC453232T-100K-PF	TDK		C0805C274K3RACTU	Kemet
	6.8 µH	LQH43MN6R8K03L	Murata	0.27 µF, 25V	08053C274KAT2A	AVX
		NLC453232T-6R8K-PF	TDK		C0805C274K3RACTU	Kemet
	4.7 µH	LQH43MN4R7K03L	Murata	0.27 µF, 25V	08053C274KAT2A	AVX
		NLC453232T-4R7K-PF	TDK		C0805C274K3RACTU	Kemet

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TABLE 5-1: EXTERNAL COMPONENT SELECTION (CONTINUED)

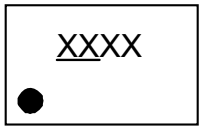
Series LEDs	L	Part #	Manufacturer	Min. C_{OUT}	Part #	Manufacturer
5, 6	22 µH	LQH43MN220K03L	Murata	0.22 µF, 25V	08053C224KAT2A	AVX
		NLC453232T-220K-PF	TDK		GRM21BR71E224KA01L	Murata
	15 µH	LQH43MN150K03L	Murata	0.22 µF, 25V	08053C224KAT2A	AVX
		NLC453232T-150K-PF	TDK		GRM21BR71E224KA01L	Murata
	10 µH	LQH43MN100K03L	Murata	0.27 µF, 25V	08053C274KAT2A	AVX
		NLC453232T-100K-PF	TDK		C0805C274K3RACTU	Kemet
	6.8 µH	LQH43MN6R8K03L	Murata	0.27 µF, 25V	08053C274KAT2A	AVX
		NLC453232T-6R8K-PF	TDK		C0805C274K3RACTU	Kemet
	4.7 µH	LQH43MN4R7K03L	Murata	0.27 µF, 25V	08053C274KAT2A	AVX
		NLC453232T-4R7K-PF	TDK		C0805C274K3RACTU	Kemet
7, 8	22 µH	LQH43MN220K03L	Murata	0.22 µF, 35V	0805DD224KAT2A	AVX
		NLC453232T-220K-PF	TDK		GRM21BR71H224KA01L	Murata
	15 µH	LQH43MN150K03L	Murata	0.22 µF, 35V	0805DD224KAT2A	AVX
		NLC453232T-150K-PF	TDK		GRM21BR71H224KA01L	Murata
	10 µH	LQH43MN100K03L	Murata	0.27 µF, 50V	08055C274KAT2A	AVX
		NLC453232T-100K-PF	TDK		C0805C274K5RACTU	Kemet
	6.8 µH	LQH43MN6R8K03L	Murata	0.27 µF, 50V	08055C274KAT2A	AVX
		NLC453232T-6R8K-PF	TDK		C0805C274K5RACTU	Kemet
	4.7 µH	LQH43MN4R7K03L	Murata	0.27 µF, 50V	08055C274KAT2A	AVX
		NLC453232T-4R7K-PF	TDK		C0805C274K5RACTU	Kemet

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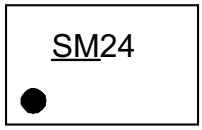
6.0 PACKAGING INFORMATION

6.1 Package Marking Information

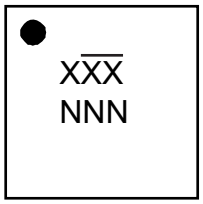
6-Lead TSOT23*



Example



8-Lead DFN*



Example

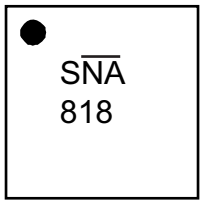


TABLE 6-1: MIC2289 PACKAGE MARKING CODES

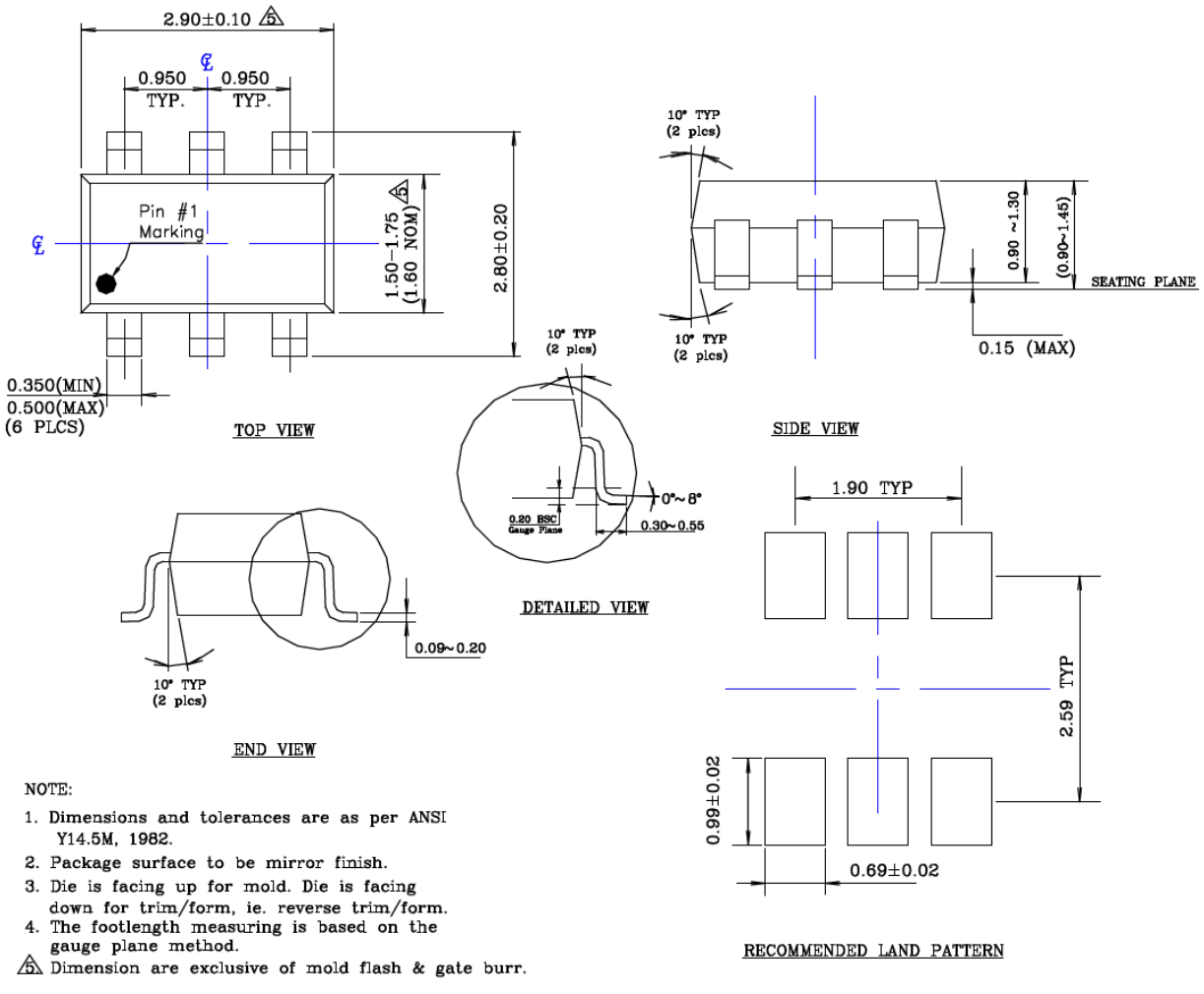
Part Number	Package	OVP	Product Code
MIC2289-24YD6	TSOT23-6	24V	SM24
MIC2289-15YML	DFN-8	15V	SNA
MIC2289-24YML	DFN-8	24V	SNB
MIC2289-34YML	DFN-8	34V	SNC

Legend:	XX...X	Product code or customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.
	●, ▲, ▼	Pin one index is identified by a dot, delta up, or delta down (triangle mark).
Note:	In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.	
	Underbar (_) and/or Overbar (¯) symbol may not be to scale.	

6-Lead Thin SOT23 Package Outline & Recommended Land Pattern

TITLE
6 LEAD SOT23 PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

DRAWING #	SOT23-6LD-PL-1	UNIT	MM



NOTE:

1. Dimensions and tolerances are as per ANSI Y14.5M, 1982.
2. Package surface to be mirror finish.
3. Die is facing up for mold. Die is facing down for trim/form, ie. reverse trim/form.
4. The footlength measuring is based on the gauge plane method.

5 Dimension are exclusive of mold flash & gate burr.

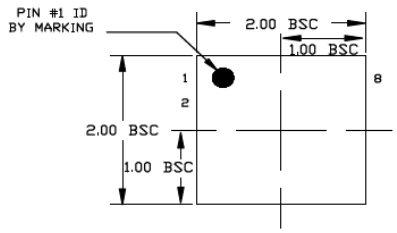
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging.

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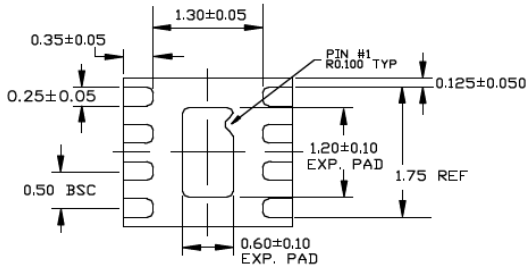
8-Lead 2 mm x 2 mm DFN Package Outline and Recommended Land Pattern

TITLE
8 LEAD DFN 2x2mm PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

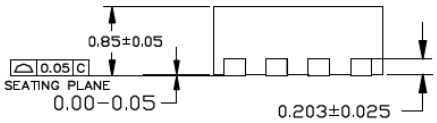
DRAWING #	DFN22-8LD-PL-1	UNIT	MM



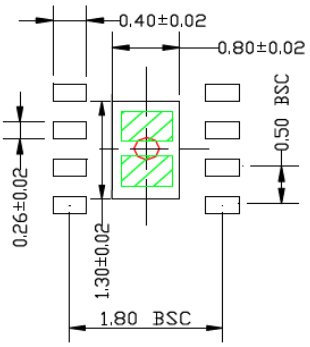
TOP VIEW
NOTE: 1, 2, 3



BOTTOM VIEW
NOTE: 1, 2, 3



END VIEW
NOTE: 1, 2, 3



RECOMMENDED LAND PATTERN
NOTE: 4, 5

NOTE:
1. MAX PACKAGE WARPAGE IS 0.05 MM
2. MAX ALLOWABLE BURR IS 0.076MM IN ALL DIRECTIONS
3. PIN #1 IS ON TOP WILL BE LASER MARKED
4. RED CIRCLE IN LAND PATTERN INDICATE THERMAL VIA. SIZE SHOULD BE 0.30-0.35MM IN DIAMETER AND SHOULD BE CONNECTED TO GND FOR MAX THERMAL PERFORMANCE
5. GREEN RECTANGLES (SHADED AREA) INDICATE SOLDER STENCIL OPENING ON EXPOSED PAD AREA. SIZE SHOULD BE 0.60x0.40 MM IN SIZE, 0.20 MM SPACING.

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging.

NOTES:

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APPENDIX A: REVISION HISTORY

Revision A (July 2019)

- Converted Micrel document MIC2289 to Microchip data sheet template DS20006207A.
- Minor grammatical corrections throughout.

NOTES:

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PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

PART NO.	-XX	X	XX	–XX
Device	Feature	Junction Temperature Range	Package	Media Type

Device:	MIC2289: White LED Driver Internal Schottky Diode and OVP		
Feature:	15	=	15V OVP (DFN Only)
	24	=	24V OVP
	34	=	34V OVP (DFN Only) (OVP = Overvoltage Protection)
Junction Temperature Range:	Y	=	–40°C to +125°C, Extended RoHS Compliant
Package:	D6	=	6-Lead TSOT (24V OVP only)
	ML	=	12-Lead 3 mm x 3 mm x 0.9 mm DFN
Media Type:	TR	=	3,000/Reel (D6, TSOT)
	TX	=	3,000/Reel (D6, TSOT), Reverse pin 1 Orientation
	TR	=	5,000/Reel (ML, DFN)

Examples:

a) MIC2289-15YML-TR:	White LED Driver Internal Schottky Diode, 15V OVP, Extended –40°C to +125°C Junction Temperature Range, RoHS compliant, 8-Lead DFN 2 mm x 2 mm x 0.9 mm Package, 5,000/Reel
b) MIC2289-24YML-TR:	White LED Driver Internal Schottky Diode, 24V OVP, Extended –40°C to +125°C Junction Temperature Range, RoHS compliant, 8-Lead DFN 2 mm x 2 mm x 0.9 mm Package, 5,000/Reel
c) MIC2289-34YML-TR:	White LED Driver Internal Schottky Diode, 34V OVP, Extended –40°C to +125°C Junction Temperature Range, RoHS compliant, 8-Lead DFN 2 mm x 2 mm x 0.9 mm Package, 5,000/Reel
d) MIC2289-24YD6-TR:	White LED Driver Internal Schottky Diode, 24V OVP, Extended –40°C to +125°C Junction Temperature Range, RoHS compliant, 6-Lead TSOT Package, 3,000/Reel
e) MIC2289-24YD6-TX:	White LED Driver Internal Schottky Diode, 24V OVP, Extended –40°C to +125°C Junction Temperature Range, RoHS compliant, 6-Lead TSOT Package, Reverse Pin 1 Orientation, 3,000/Reel

Note 1: Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.

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NOTES:

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