1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings†

Drain-to-Source Voltage ..... BV_{DSS}
Drain-to-Gate Voltage ..... BV_{DGS}
Gate-to-Source Voltage ..... ±20V
Operating Ambient Temperature, T_A ..... –55°C to +150°C
Storage Temperature, T_S ..... –55°C to +150°C

† 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.

DC ELECTRICAL CHARACTERISTICS

Electrical Specifications: T_A = 25°C unless otherwise specified. All DC parameters are 100% tested at 25°C unless otherwise stated. Pulse test: 300 µs pulse, 2% duty cycle

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Drain-to-Source Breakdown Voltage	BV_{DSS}	400	—	—	V	V_{GS} = 0V, I_D = 100 µA
Gate Threshold Voltage	$V_{GS(th)}$	0.6	—	2	V	V_{GS} = V_{DS}, I_D = 1 mA
Change in $V_{GS(th)}$ with Temperature	$\Delta V_{GS(th)}$	—	–2.5	–4	mV/°C	V_{GS} = V_{DS}, I_D = 1 mA (**Note 1**)
Gate Body Leakage Current	I_{GSS}	—	—	100	nA	V_{GS} = ±20V, V_{DS} = 0V
Zero-Gate Voltage Drain Current	I_{DSS}	—	—	10	µA	V_{GS} = 0V, V_{DS} = Maximum rating
		—	—	1	mA	V_{DS} = 0.8 Maximum rating, V_{GS} = 0V, T_A = 125°C (**Note 1**)
On-State Drain Current	$I_{D(ON)}$	0.3	0.5	—	A	V_{GS} = 4.5V, V_{DS} = 25V
		0.75	1	—	A	V_{GS} = 10V, V_{DS} = 25V
Static Drain-to-Source On-State Resistance	$R_{DS(ON)}$	—	8	12	Ω	V_{GS} = 4.5V, I_D = 150 mA
		—	8	12	Ω	V_{GS} = 10V, I_D = 500 mA
Change in $R_{DS(ON)}$ with Temperature	$\Delta R_{DS(ON)}$	—	—	0.75	%/°C	V_{GS} = 10V, I_D = 500 mA (**Note 1**)

Note 1: Specification is obtained by characterization and is not 100% tested.

AC ELECTRICAL CHARACTERISTICS

Electrical Specifications: T_A = 25°C unless otherwise specified. All AC parameters are not 100% sample tested.						
Parameter	**Sym.**	**Min.**	**Typ.**	**Max.**	**Unit**	**Conditions**
Forward Transconductance	G_{FS}	125	200	—	mmho	V_{DS} = 25V, I_D = 100 mA
Input Capacitance	C_{ISS}	—	95	125	pF	V_{GS} = 0V, V_{DS} = 25V, f = 1 MHz
Common-Source Output Capacitance	C_{OSS}	—	20	70	pF	
Reverse Transfer Capacitance	C_{RSS}	—	10	25	pF	
Turn-On Delay Time	$t_{d(ON)}$	—	—	20	ns	V_{DD} = 25V, I_D = 1A, R_{GEN} = 25Ω
Rise Time	t_r	—	—	15	ns	
Turn-Off Delay Time	$t_{d(OFF)}$	—	—	25	ns	
Fall Time	t_f	—	—	20	ns	
DIODE PARAMETER						
Diode Forward Voltage Drop	V_{SD}	—	—	1.8	V	V_{GS} = 0V, I_{SD} = 200 mA (**Note 1**)
Reverse Recovery Time	t_{rr}	—	300	—	ns	V_{GS} = 0V, I_{SD} = 1A

Note 1: All DC parameters are 100% tested at 25°C unless otherwise stated.
Pulse test: 300 µs pulse, 2% duty cycle

TEMPERATURE SPECIFICATIONS

Parameter	**Sym.**	**Min.**	**Typ.**	**Max.**	**Unit**	**Conditions**
TEMPERATURE RANGE						
Operating Ambient Temperature	T_A	–55	—	+150	°C	
Storage Temperature	T_S	–55	—	+150	°C	
PACKAGE THERMAL RESISTANCE						
3-lead TO-92	θ_{JA}	—	132	—	°C/W	
3-lead SOT-89	θ_{JA}	—	73	—	°C/W	

THERMAL CHARACTERISTICS

Package	**I_D (Note 1) (Continuous) (mA)**	**I_D (Pulsed) (A)**	**Power Dissipation at T_A = 25°C (W)**	**I_{DR} (Note 1) (mA)**	**I_{DRM} (A)**
3-lead TO-92	175	2	1	175	2
3-lead SOT-89	260	1.8	1.6 (**Note 2**)	260	1.8

Note 1: I_D (continuous) is limited by maximum rated T_J.

2: T_A = 25°C. Mounted on an FR5 Board, 25 mm x 25 mm x 1.57 mm.

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.

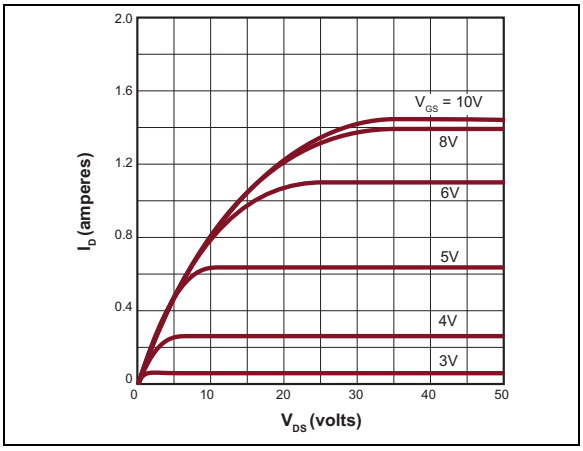


FIGURE 2-1: *Output Characteristics.*

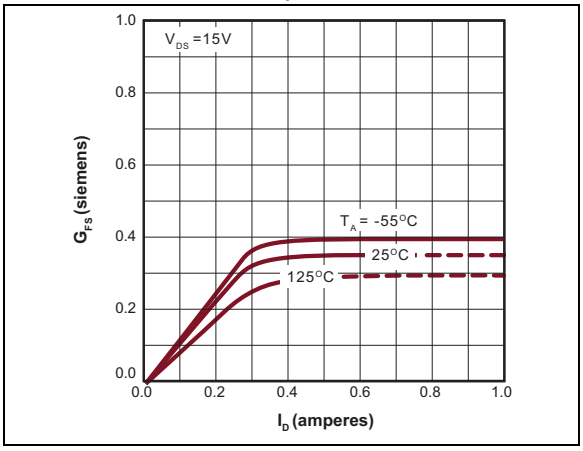


FIGURE 2-2: *Transconductance vs. Drain Current.*

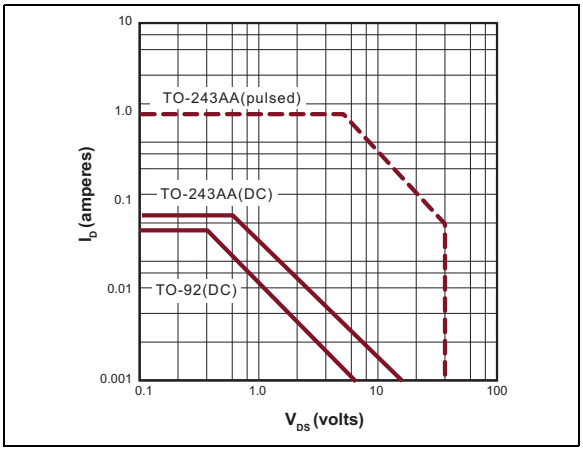


FIGURE 2-3: *Maximum Rated Safe Operating Area.*

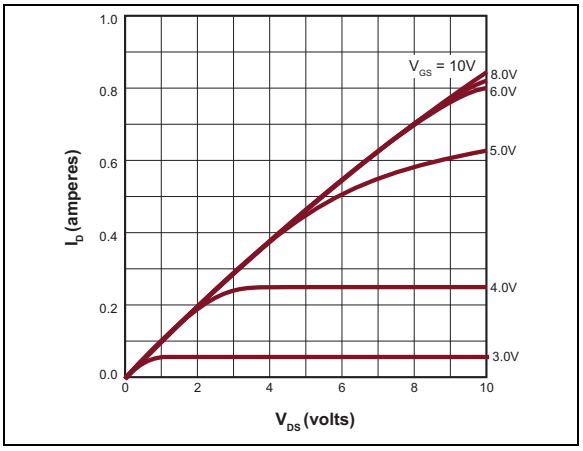


FIGURE 2-4: *Saturation Characteristics.*

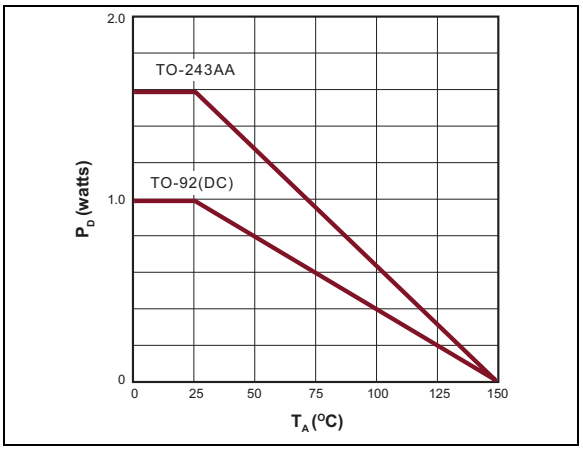


FIGURE 2-5: *Power Dissipation vs. Ambient Temperature.*

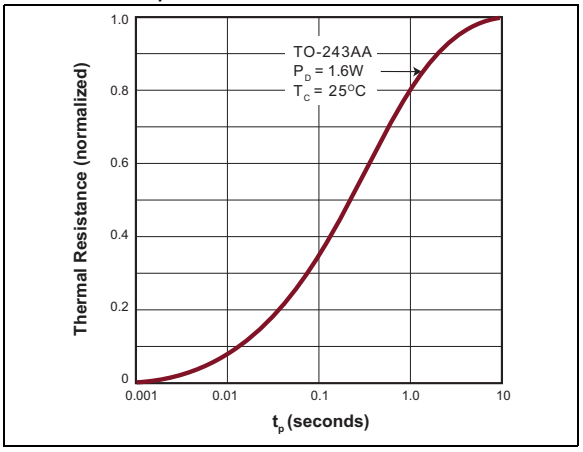


FIGURE 2-6: *Thermal Response Characteristics.*

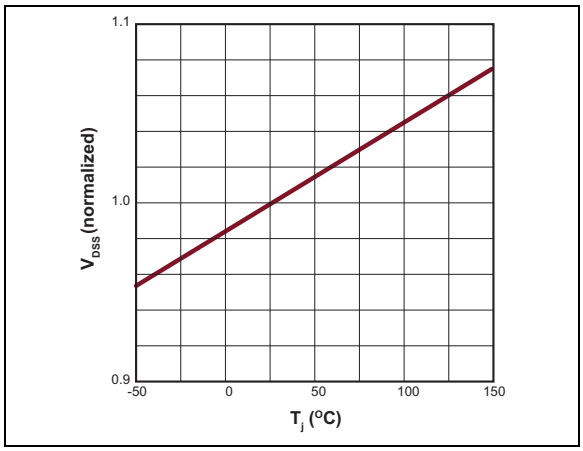


FIGURE 2-7: *BV_{DSS} Variation with Temperature.*

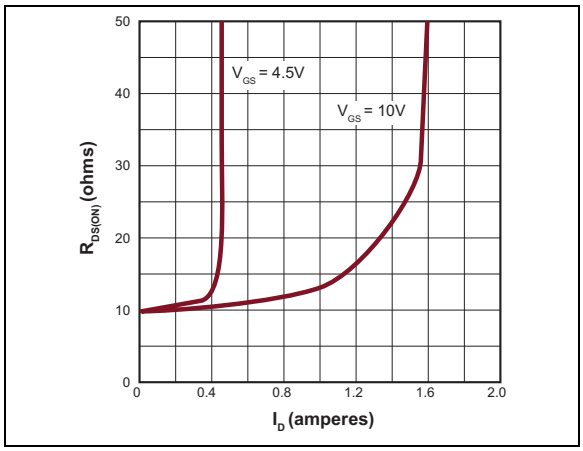


FIGURE 2-10: *On-Resistance vs. Drain Current.*

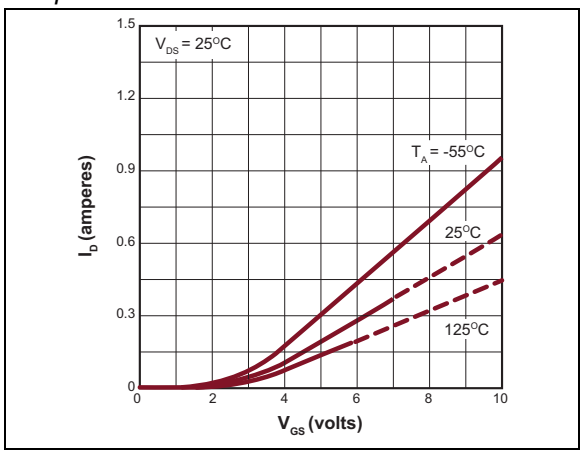


FIGURE 2-8: *Transfer Characteristics.*

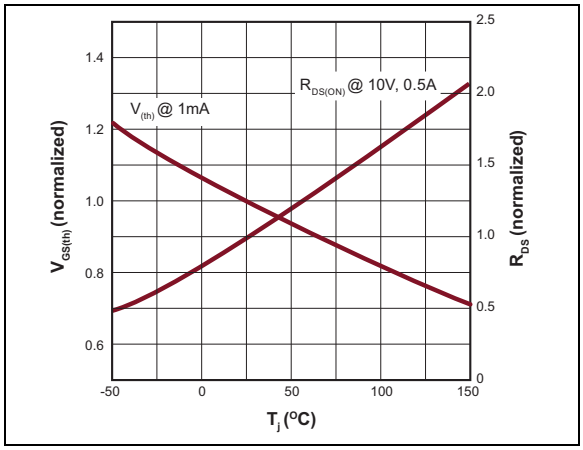


FIGURE 2-11: *$V_{GS(th)}$ and $R_{DS(ON)}$ with Temperature.*

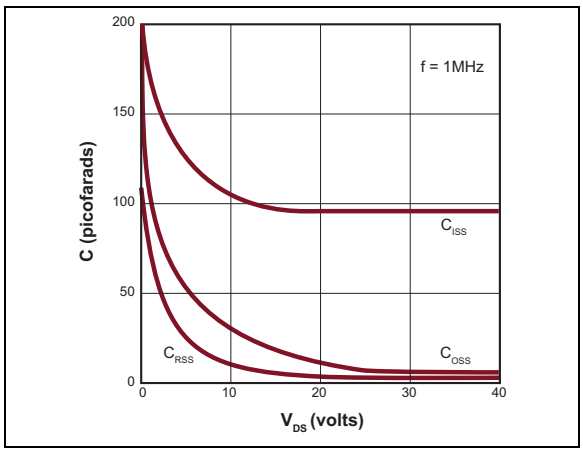


FIGURE 2-9: *Capacitance vs. Drain-to-Source Voltage.*

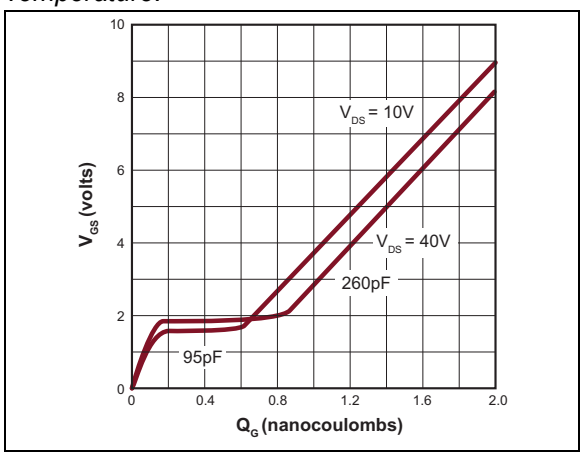


FIGURE 2-12: *Gate Drive Dynamic Characteristics.*

3.0 PIN DESCRIPTION

The details on the pins of TN2540 are listed in Table 3-1 and Table 3-2. Refer to **Package Types** for the location of pins.

TABLE 3-1: TO-92 PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1	Source	Source
2	Gate	Gate
3	Drain	Drain

TABLE 3-2: SOT-89 PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1	Gate	Gate
2,4	Drain	Drain
3	Source	Source

4.0 FUNCTIONAL DESCRIPTION

Figure 4-1 illustrates the switching waveforms and test circuit for TN2540.

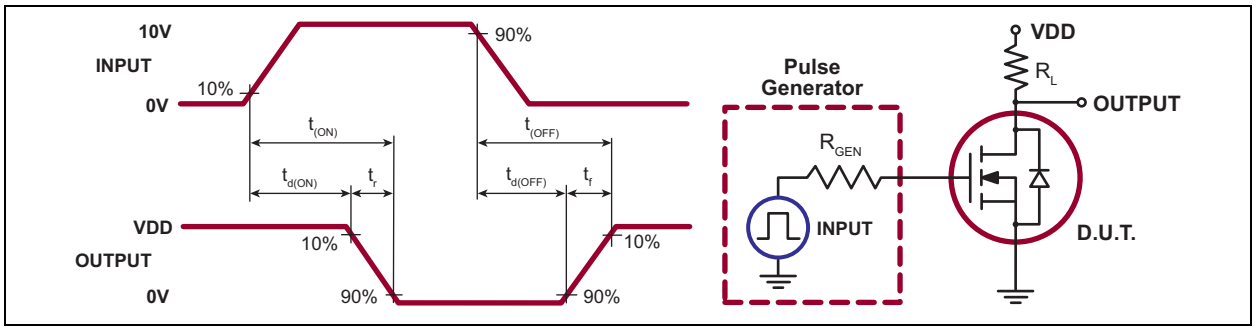


FIGURE 4-1: *Switching Waveforms and Test Circuit.*

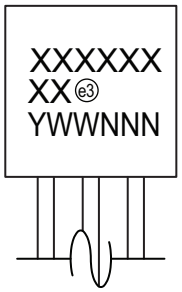
TABLE 4-1: PRODUCT SUMMARY

BV_{DSS}/BV_{DGS} (V)	$R_{DS(ON)}$ (Maximum) (Ω)	$I_{D(ON)}$ (Minimum) (A)	$V_{GS(TH)}$ (Maximum) (V)
400	12	1	2

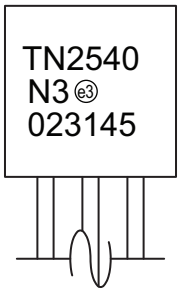
5.0 PACKAGING INFORMATION

5.1 Package Marking Information

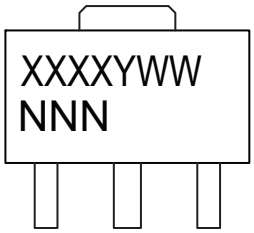
3-lead TO-92



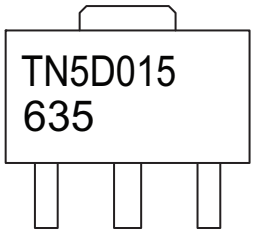
Example



3-lead SOT-89



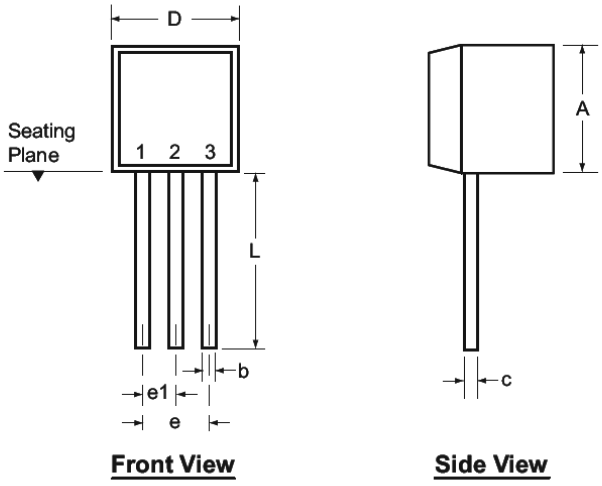
Example

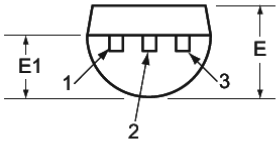


Legend:	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.

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 product code or customer-specific information. Package may or not include the corporate logo.

3-Lead TO-92 Package Outline (L/LL/N3)



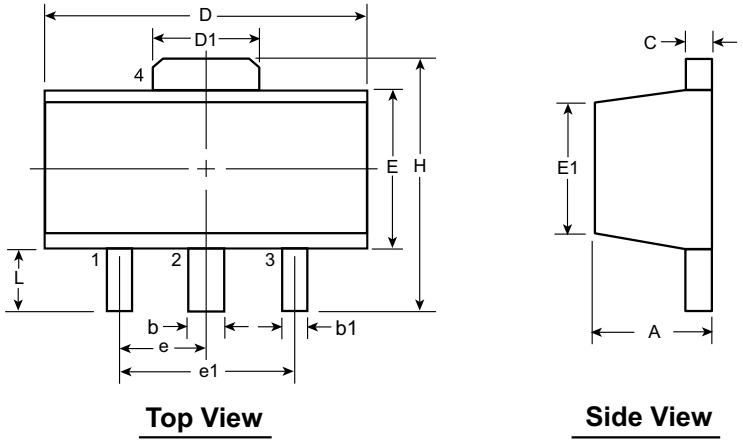


Note: For the most current package drawings, see the Microchip Packaging Specification at www.microchip.com/packaging.

Symbol		A	b	c	D	E	E1	e	e1	L
Dimensions (inches)	MIN	.170	.014†	.014†	.175	.125	.080	.095	.045	.500
	NOM	-	-	-	-	-	-	-	-	-
	MAX	.210	.022†	.022†	.205	.165	.105	.105	.055	.610*

JEDEC Registration TO-92.
** This dimension is not specified in the JEDEC drawing.*
† This dimension differs from the JEDEC drawing.
Drawings not to scale.

3-Lead TO-243AA (SOT-89) Package Outline (N8)



Top View **Side View**

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

Symbol		A	b	b1	C	D	D1	E	E1	e	e1	H	L
Dimensions (mm)	MIN	1.40	0.44	0.36	0.35	4.40	1.62	2.29	2.00†	1.50 BSC	3.00 BSC	3.94	0.73†
	NOM	-	-	-	-	-	-	-	-			-	-
	MAX	1.60	0.56	0.48	0.44	4.60	1.83	2.60	2.29			4.25	1.20

JEDEC Registration TO-243, Variation AA, Issue C, July 1986.
† This dimension differs from the JEDEC drawing
Drawings not to scale.

APPENDIX A: REVISION HISTORY

Revision A (November 2020)

- Converted Supertex Doc# DSFP-TN2540 to Microchip DS20005954A
- Changed the package marking format
- Removed the TO-92 P003, P004, P005, P013, and P014 media types from the N3 package to align specifications with the actual BQM
- Made minor text changes throughout the document

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	-	X
Device	Package Options		Environmental		Media Type

Device:	TN2540	=	N-Channel Enhancement-Mode Vertical DMOS FET
Packages:	N3	=	3-lead TO-92
	N8	=	3-lead SOT-89
Environmental:	G	=	Lead (Pb)-free/RoHS-compliant Package
Media Types:	(blank)	=	1000/Bag for an N3 Package
		=	2000/Reel for an N8 Package
	P002	=	2000/Reel for an N3 Package

Examples:

a) TN2540N3-G:	N-Channel Enhancement-Mode, Vertical DMOS FET, 3-lead TO-92, 1000/Bag
b) TN2540N3-G-P002:	N-Channel Enhancement-Mode, Vertical DMOS FET, 3-lead TO-92, 2000/Reel
c) TN2540N8-G:	N-Channel Enhancement-Mode, Vertical DMOS FET, 3-lead SOT-89, 2000/Reel

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods being used in attempts to breach the code protection features of the Microchip devices. We believe that these methods require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Attempts to breach these code protection features, most likely, cannot be accomplished without violating Microchip's intellectual property rights.
- Microchip is willing to work with any customer who is concerned about the integrity of its code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "unbreakable." Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.

Trademarks

ISBN: 978-1-5224-7138-7

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
http://www.microchip.com/support
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX
Tel: 512-257-3370

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Novi, MI
Tel: 248-848-4000

Houston, TX
Tel: 281-894-5983

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453
Tel: 317-536-2380

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608
Tel: 951-273-7800

Raleigh, NC
Tel: 919-844-7510

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110
Tel: 408-436-4270

Canada - Toronto
Tel: 905-695-1980
Fax: 905-695-2078

ASIA/PACIFIC

Australia - Sydney
Tel: 61-2-9868-6733

China - Beijing
Tel: 86-10-8569-7000

China - Chengdu
Tel: 86-28-8665-5511

China - Chongqing
Tel: 86-23-8980-9588

China - Dongguan
Tel: 86-769-8702-9880

China - Guangzhou
Tel: 86-20-8755-8029

China - Hangzhou
Tel: 86-571-8792-8115

China - Hong Kong SAR
Tel: 852-2943-5100

China - Nanjing
Tel: 86-25-8473-2460

China - Qingdao
Tel: 86-532-8502-7355

China - Shanghai
Tel: 86-21-3326-8000

China - Shenyang
Tel: 86-24-2334-2829

China - Shenzhen
Tel: 86-755-8864-2200

China - Suzhou
Tel: 86-186-6233-1526

China - Wuhan
Tel: 86-27-5980-5300

China - Xian
Tel: 86-29-8833-7252

China - Xiamen
Tel: 86-592-2388138

China - Zhuhai
Tel: 86-756-3210040

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-3090-4444

India - New Delhi
Tel: 91-11-4160-8631

India - Pune
Tel: 91-20-4121-0141

Japan - Osaka
Tel: 81-6-6152-7160

Japan - Tokyo
Tel: 81-3-6880- 3770

Korea - Daegu
Tel: 82-53-744-4301

Korea - Seoul
Tel: 82-2-554-7200

Malaysia - Kuala Lumpur
Tel: 60-3-7651-7906

Malaysia - Penang
Tel: 60-4-227-8870

Philippines - Manila
Tel: 63-2-634-9065

Singapore
Tel: 65-6334-8870

Taiwan - Hsin Chu
Tel: 886-3-577-8366

Taiwan - Kaohsiung
Tel: 886-7-213-7830

Taiwan - Taipei
Tel: 886-2-2508-8600

Thailand - Bangkok
Tel: 66-2-694-1351

Vietnam - Ho Chi Minh
Tel: 84-28-5448-2100

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4485-5910
Fax: 45-4485-2829

Finland - Espoo
Tel: 358-9-4520-820

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Garching
Tel: 49-8931-9700

Germany - Haan
Tel: 49-2129-3766400

Germany - Heilbronn
Tel: 49-7131-72400

Germany - Karlsruhe
Tel: 49-721-625370

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Germany - Rosenheim
Tel: 49-8031-354-560

Israel - Ra'anana
Tel: 972-9-744-7705

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Italy - Padova
Tel: 39-049-7625286

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Norway - Trondheim
Tel: 47-7288-4388

Poland - Warsaw
Tel: 48-22-3325737

Romania - Bucharest
Tel: 40-21-407-87-50

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Gothenberg
Tel: 46-31-704-60-40

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820