

IGBT - NPT

1200 V, 40 A

FGH40N120AN

Description

Employing NPT technology, ON Semiconductor's AN series of IGBTs provides low conduction and switching losses. The AN series offers an solution for application such as induction heating (IH), motor control, general purpose inverters and uninterruptible power supplies (UPS).

Features

- High Speed Switching
- Low Saturation Voltage: $V_{CE(sat)} = 2.6 \text{ V @ } I_C = 40 \text{ A}$
- High Input Impedance
- This Device is Pb-Free and is RoHS Compliant

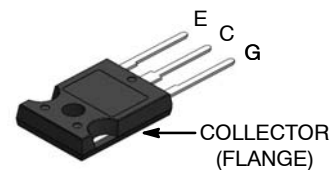
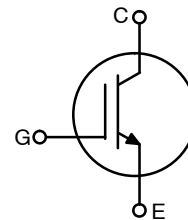
Applications

- Induction Heating, UPC, AC & DC Motor Controls and General Purpose Inverters



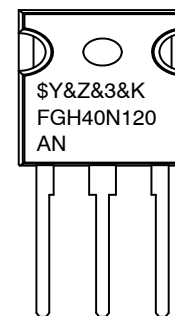
ON Semiconductor®

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TO-247-3LD
CASE 340CK

MARKING DIAGRAM



\$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FGH40N120AN	= Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

FGH40N120AN

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Parameter		Symbol	FGH40N120AN	Unit
Collector to Emitter Voltage		V _{CES}	1200	V
Gate to Emitter Voltage		V _{GES}	±25	V
Collector Current	T _C = 25°C	I _C	64	A
Collector Current	T _C = 100°C		40	A
Pulsed Collector Current		I _{CM} (Note 1)	160	A
Maximum Power Dissipation	T _C = 25°C	P _D	417	W
Maximum Power Dissipation	T _C = 100°C		167	W
Short Circuit Withstand Time, V _{CE} = 600 V, V _{GE} = 15 V, T _C = 125°C		SCWT	10	μs
Operating Junction Temperature		T _J	–55 to +150	°C
Storage Temperature Range		T _{STG}	–55 to +150	°C
Maximum Lead Temp. for Soldering Purposes, 1/8" from Case for 5 Seconds		T _L	300	°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. Pulse width limited by max. junction temperature.

THERMAL CHARACTERISTICS

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance, Junction to Case	R _{θJC} (IGBT)	–	0.3	°C/W
Thermal Resistance, Junction to Ambient	R _{θJA}	–	40	°C/W

PACKAGE MARKING AND ORDERING INFORMATION

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGH40N120AN	FGH40N120AN	TO-247	–	–	30

ELECTRICAL CHARACTERISTICS OF THE IGBT (T_C = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector to Emitter Breakdown Voltage	BV _{CES}	V _{GE} = 0 V, I _C = 1 mA	1200	–	–	V
Temperature Coefficient of Breakdown Voltage	ΔBV _{CES} /ΔT _J	V _{GE} = 0 V, I _C = 1 mA	–	0.6	–	V/°C
Collector Cut-Off Current	I _{CES}	V _{CE} = V _{CES} , V _{GE} = 0 V	–	–	1	mA
G–E Leakage Current	I _{GES}	V _{GE} = V _{GES} , V _{CE} = 0 V	–	–	±250	nA

ON CHARACTERISTICS

G–E Threshold Voltage	V _{GE(th)}	I _C = 250 μA, V _{CE} = V _{GE}	3.5	5.5	7.5	V
Collector to Emitter Saturation Voltage	V _{CE(sat)}	I _C = 40 A, V _{GE} = 15 V	–	2.6	3.2	V
		I _C = 40 A, V _{GE} = 15 V, T _C = 125°C	–	2.9	–	V
		I _C = 64 A, V _{GE} = 15 V	–	3.15	–	V

FGH40N120AN

ELECTRICAL CHARACTERISTICS OF THE IGBT ($T_C = 25^\circ\text{C}$ unless otherwise noted) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ies}	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	–	3200	–	pF
Output Capacitance	C_{oes}		–	370	–	pF
Reverse Transfer Capacitance	C_{res}		–	125	–	pF
SWITCHING CHARACTERISTICS						
Turn–On Delay Time	$t_{d(on)}$	$V_{CC} = 600\text{ V}, I_C = 40\text{ A},$ $R_G = 5\text{ }\Omega, V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 25^\circ\text{C}$	–	15	–	ns
Rise Time	t_r		–	20	–	ns
Turn–Off Delay Time	$t_{d(off)}$		–	110	–	ns
Fall Time	t_f		–	40	80	ns
Turn–On Switching Loss	E_{on}		–	2.3	3.45	mJ
Turn–Off Switching Loss	E_{off}		–	1.1	1.65	mJ
Total Switching Loss	E_{ts}			3.4	5.1	mJ
Turn–On Delay Time	$t_{d(on)}$	$V_{CC} = 600\text{ V}, I_C = 40\text{ A},$ $R_G = 5\text{ }\Omega, V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 125^\circ\text{C}$	–	20	–	ns
Rise Time	t_r		–	25	–	ns
Turn–Off Delay Time	$t_{d(off)}$		–	120	–	ns
Fall Time	t_f		–	45	–	ns
Turn–On Switching Loss	E_{on}		–	2.5	–	mJ
Turn–Off Switching Loss	E_{off}		–	1.8	–	mJ
Total Switching Loss	E_{ts}		–	4.3	–	mJ
Total Gate Charge	Q_g	$V_{CE} = 600\text{ V}, I_C = 40\text{ A}, V_{GE} = 15\text{ V}$	–	220	–	nC
Gate to Emitter Charge	Q_{ge}		–	25	–	nC
Gate to Collector Charge	Q_{gc}		–	130	–	nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL PERFORMANCE CHARACTERISTICS

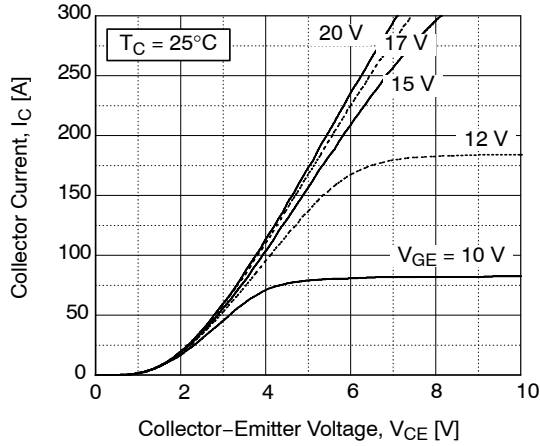


Figure 1. Typical Output Characteristics

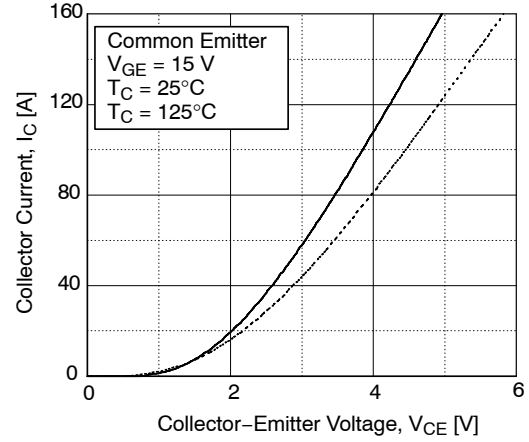


Figure 2. Typical Saturation Voltage Characteristics

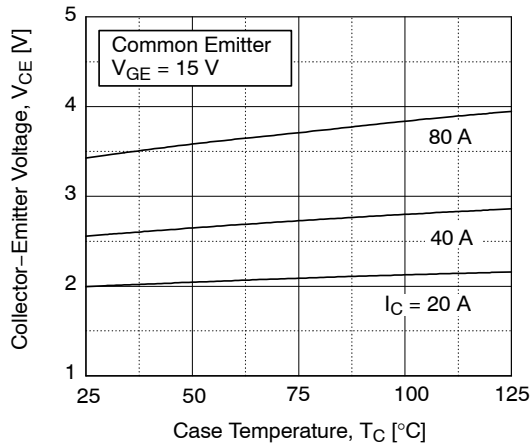


Figure 3. Saturation Voltage vs. Case Temperature at Variant Current Level

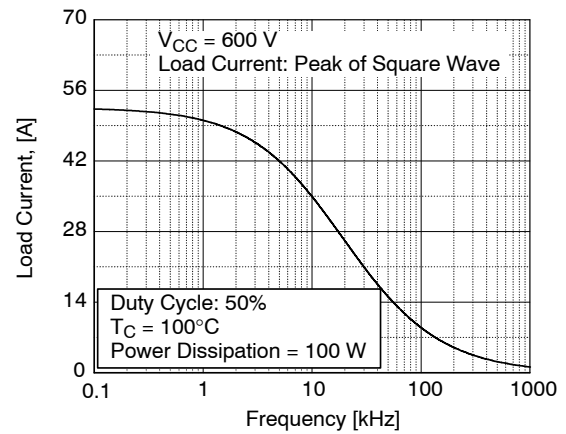


Figure 4. Load Current vs. Frequency

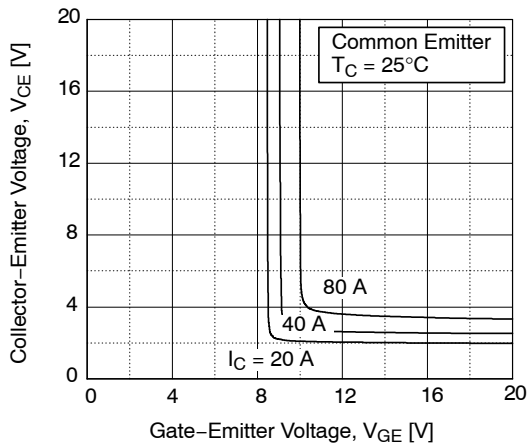


Figure 5. Saturation Voltage vs. V_{GE}

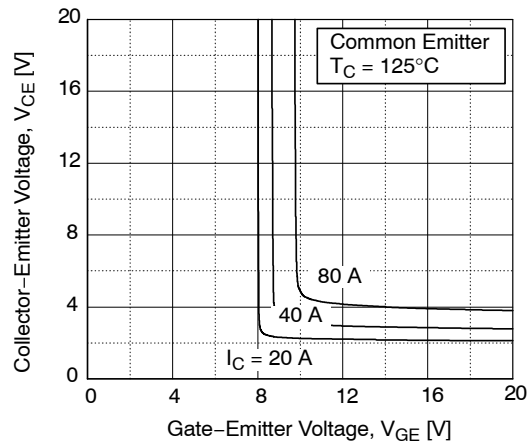


Figure 6. Saturation Voltage vs V_{GE}

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

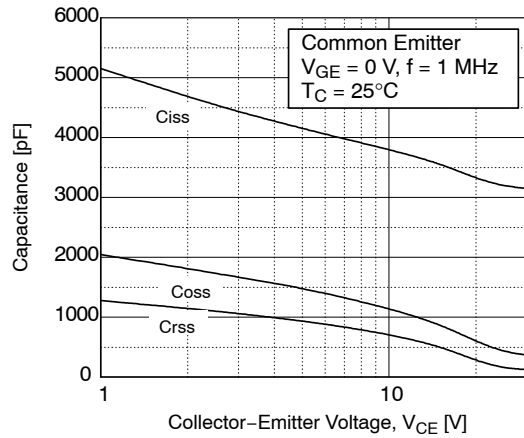


Figure 7. Capacitance Characteristics

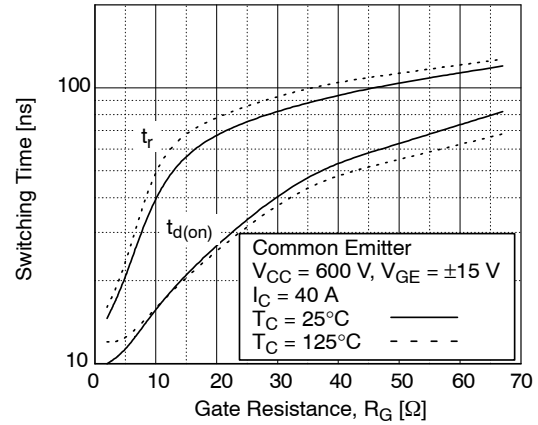


Figure 8. Turn-On Characteristic vs. Gate Resistance

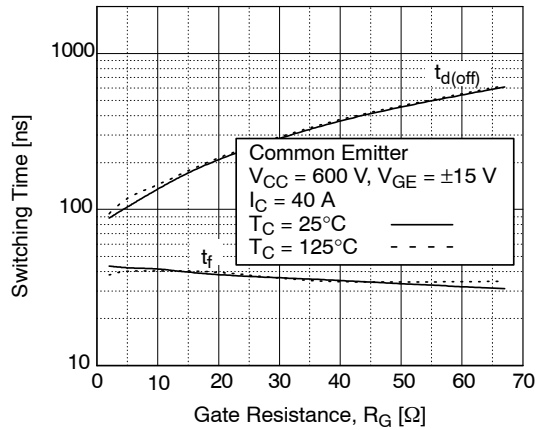


Figure 9. Turn-Off Characteristics vs. Gate Resistance

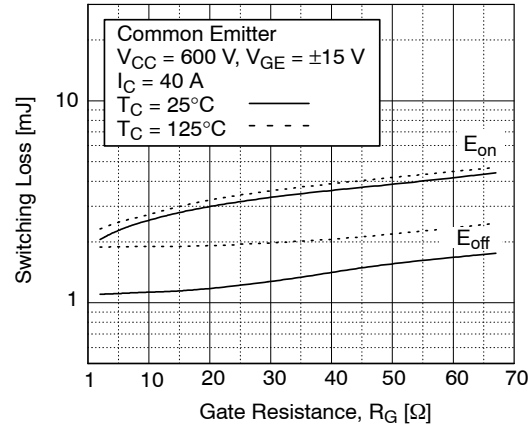


Figure 10. Switching Loss vs. Gate Resistance

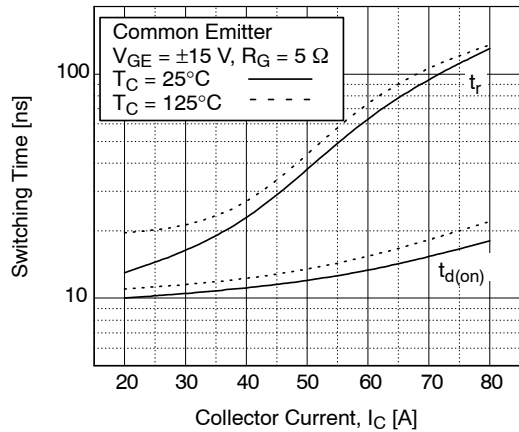


Figure 11. Turn-On Characteristics vs. Collector Current

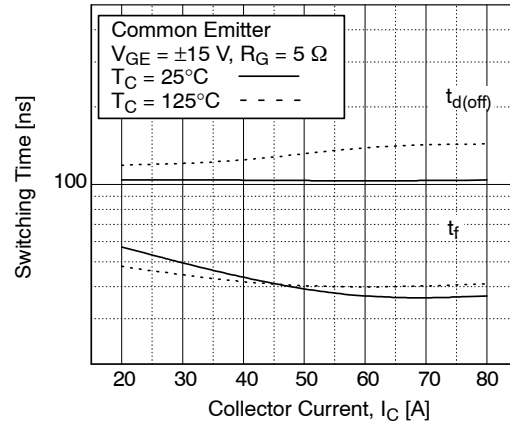


Figure 12. Turn-Off Characteristics vs. Collector Current

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

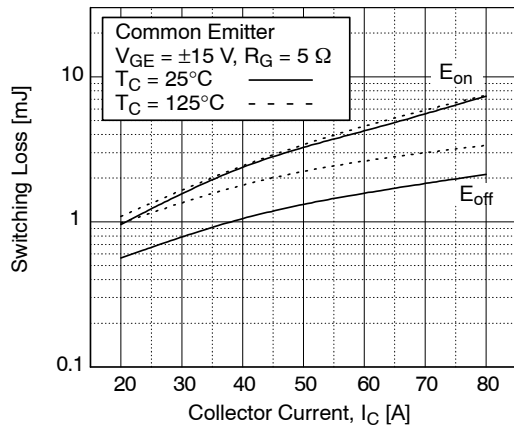


Figure 13. Switching Loss vs. Collector Current

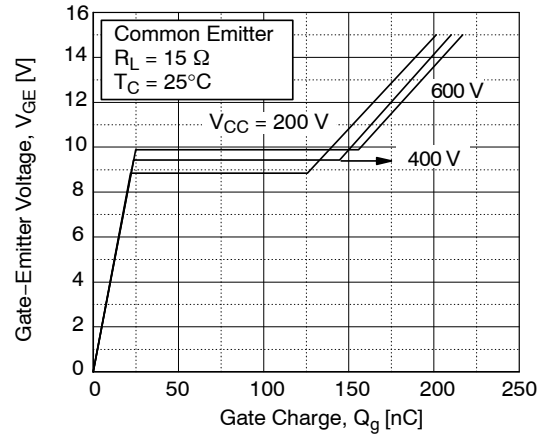


Figure 14. Gate Charge Characteristics

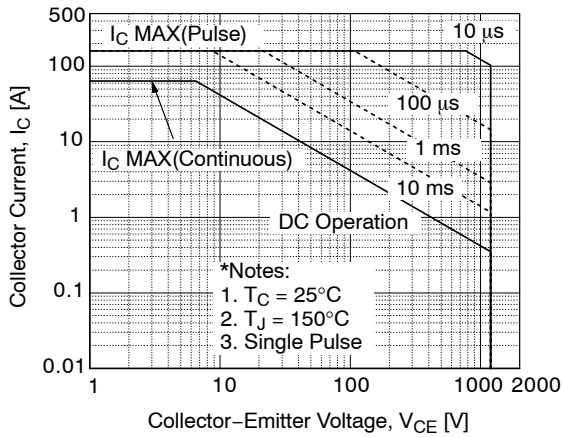


Figure 15. SOA Characteristics

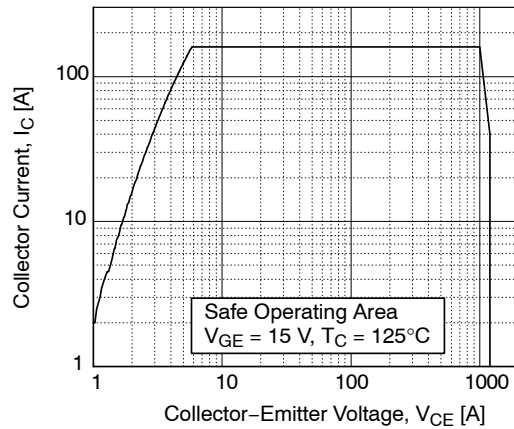


Figure 16. Turn-Off SOA

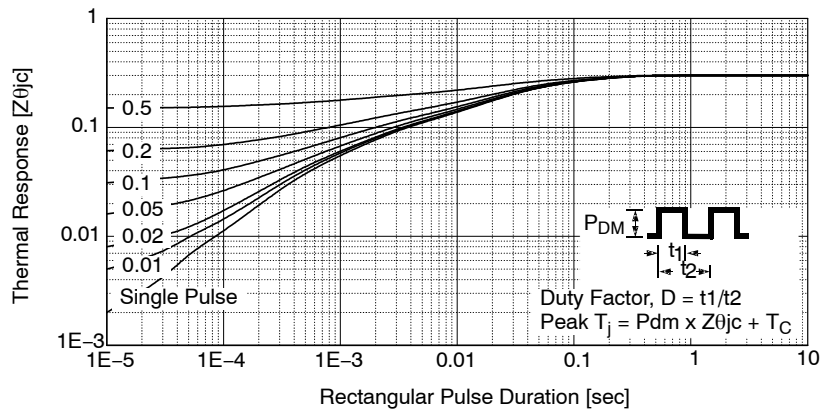
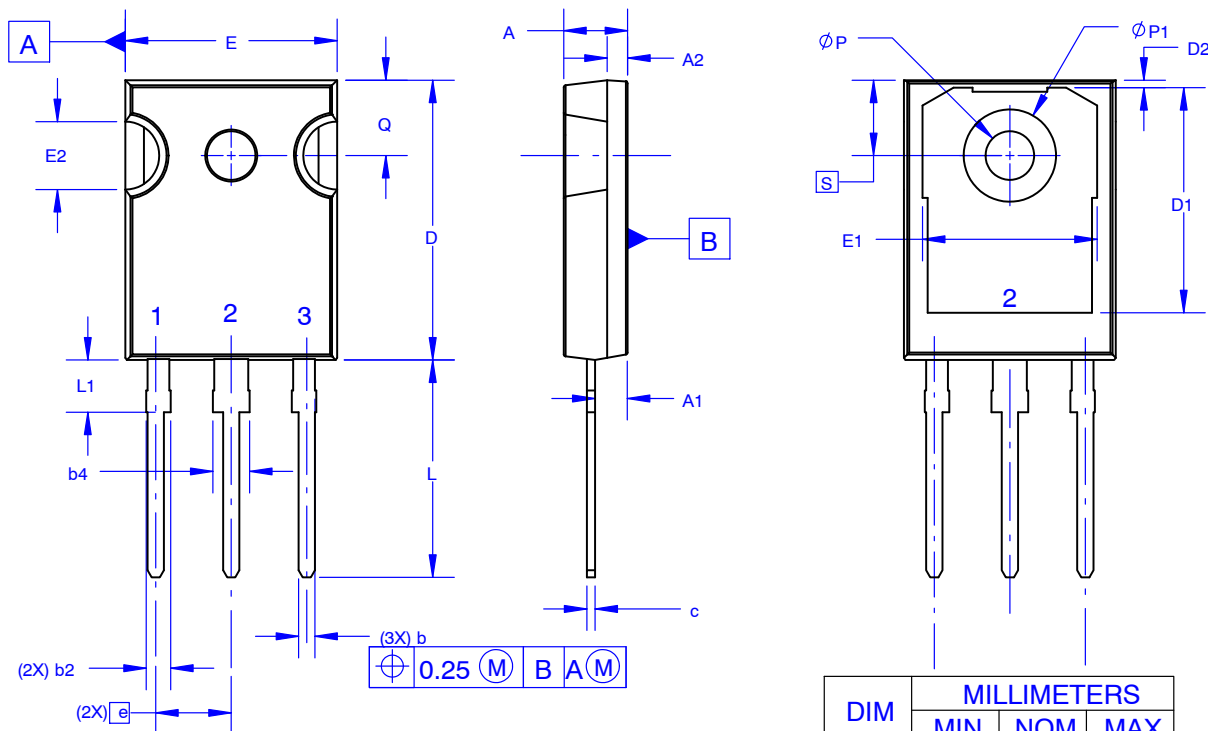


Figure 17. Transient Thermal Impedance of IGBT

TO-247-3LD SHORT LEAD CASE 340CK ISSUE A

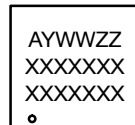
DATE 31 JAN 2019



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

GENERIC MARKING DIAGRAM*



XXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Assembly Lot Code

*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.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93
ϕP	3.51	3.58	3.65
$\phi P1$	6.60	6.80	7.00
Q	5.34	5.46	5.58
S	5.34	5.46	5.58

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DESCRIPTION:	TO-247-3LD SHORT LEAD	PAGE 1 OF 1

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